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THE CHICAGO ELECTRICAL SHOW.

The fourth annual electrical exposition held at the Coliseum, Chicago, will run from January 16 to January 30. At the present time there appears to be no question as to the success of the show, as every available square foot of space has been taken up, and the list of exhibitors is thoroughly representative.

A feature of the show will be the working exhibits, many of them industrial in character. The Commonwealth Edison Company has made elaborate plans along these lines. Another feature which will add great importance to the show is the exhibit of the United States Government, which will occupy the entire Coliseum Annex. This will comprise a display of electrical machinery and apparatus such as is used in the equipment of the modern battleship. It is stated that of the $7,000,000 spent on the equipment of one of these new battleships, $600,000 went to the electrical manufacturers.

The same booths will be used this year, but the roof interior will be changed, and will be particularly unique in appearance and design. The illumination will be provided by means of 10,000 tungsten lamps in arches over the aisles, from booth to booth.

Special souvenir and convention days have been arranged, and notable among these will be the attendance of the Chicago Electric Club on Wednesday, January 20; the Northwestern Electrical Association on Friday, January 22; the Sons of Jove on Wednesday, January 27, and the reunion of old Thomson-Houston employés on Thursday, January 28.

TACOMA'S EXPERIENCE WITH ITS POWER PLANT.

According to a summary published in a recent issue of the Tacoma (Wash.) *News,* the city purchased a power plant in 1893, which was invoiced at $178,940. The plant consisted of thirteen boilers and fittings, valued at $12,800. There were nine engines, valued at $53,000, and fifteen dynamos and auxiliary apparatus, valued at $120,370.

It appears that there is no record of what it cost the city to manufacture its own electricity. In the comptroller's report for 1898, when the city received its power from the lighting system of the Tacoma Railways Company, it is stated that a saving was effected compared with the operation of the old electric-light plant by the city. The Tacoma Railways Company used the same plant, however, which had been operated as a municipal proposition by the city, and which had proved a failure financially. According to the same records, it appears that in 1905 the receipts, in round numbers, were $28,000;

operating the plant cost $45,500, and repairs and maintenance cost $6,500, not including the interest on the investment, amounting to another $12,500. In 1906 the operating, repairs and maintenance cost was $36,000, without the interest, and the receipts were $28,000. In 1907 the figures were respectively $41,000 and $35,000.

NICKEL-IN-THE-SLOT CARS FOR NEW YORK CITY.

Announcement has been made that new pay-as-you-enter cars will be run on the Third Avenue line of the New York city electric-railway system. Each car will have a fare box on the rear platform, and passengers will be requested to have their nickels ready. The conductors will furnish change, if necessary. The conductors will not be allowed to handle the fares, and each passenger will put his fare in the box, but will hand transfer tickets to the conductor. Passengers desiring transfers must ask for them at the time they put their fare in the box. Conductors are not allowed to issue them afterward.

These cars will resemble in most respects the present pay-as-you-enter cars with which the residents of New York, Chicago and other large cities are now familiar. The fare boxes will be fastened to the rail behind which the conductor stands. Their tops are of heavy plate glass, and slides are arranged so that a coin, once deposited, cannot be withdrawn. A series of keys enables the conductor to register the fares, and the coins drop into a receiver beneath. At the end of his run the conductor unlocks the receiver and takes it into the office. Inside is still another box, the key of which is kept in the receiver's office. By this means the conductor has no occasion to handle any of the receipts. If he must make change, he must hand the passenger the whole amount, and the passenger must then deposit his fare.

F. W. Whitridge, who is now in charge of the Third Avenue system, states that the company has been losing from six to seven per cent of its receipts through dishonesty of conductors or through failure to collect fares. It is hoped to eliminate this loss and to keep the conductors where they will be most efficient—on the rear platform of the car. Certainly, anyone who has made use of the new pay-as-you-enter cars has not failed to enjoy the elimination of the moving up and down a crowded car of a conductor in search of elusive fares. The pay-as-you-enter car has thus done away with one of the greatest annoyances and nuisances of modern street-car travel.

The fare-box proposition is an innovation in modern street railways. We were familiar with it in the old bob-tailed horse-car and stage-coach days. Then it was that few people stole a ride at the expense of the company. No one appeared to have the dare to sit in the stage-coach or on the bob-tail and refrain from putting his fare in the box, because each neighboring passenger felt it his duty to see that the possibly guilty one was made most uncomfortable until he had paid his fare.

The scheme has some good points, but it also has one bad one. This will be demonstrated if the riders insist on boarding the cars at intersecting points in large numbers at one time, all expecting the conductor to make change for them at once. Eight or ten people on the rear platform of one of these cars at one time either will hold up the car until they are all inside, or will render it very likely that injury may occur to the last one aboard, if the car is started before all are safely in the vestibule. The scheme can be made a success which will be appreciated by everyone using the system if a little thought be given to the necessity of providing oneself with a few spare nickels. If the pay-as-you-enter habit grows, it is easily possible to believe that men will automatically do this, and thus facilitate in a great measure electric-railway transportation in big cities.

WINNIPEG.

Mr. Charles F. Roland, commissioner for Winnipeg, Canada, has compiled some interesting figures dealing with the attractiveness of that city as a natural distributing centre where cheap power, railway facilities, new territory and new business are available.

The city has under construction a municipal electric plant of 60,000 horsepower capacity. This is a hydroelectric works on the falls at Point du Bois. The original installation will have a rated capacity of 20,000 horsepower, and current will be transmitted at high tension to Winnipeg, and there transformed and distributed to consumers. The Winnipeg Electric Railway Company operates an extensive street railway system from a hydroelectric plant of 28,000 horsepower capacity.

The city has a population of 118,000. It has 675 electric street arc lights, twenty-two pairs of railway tracks radiating from the city; the electric railway operates 140 cars on sixty miles of city tracks and forty-four miles of suburban lines, and its gross receipts in 1907 were $1,722,406, carrying seventeen and one-quarter millions of passengers.

PUBLIC TELEPHONES IN SUBWAY STATIONS.

On another page of this issue is described the telephone service which has been established in the new tunnel under Washington Street, Boston, Mass. This is probably the most complete telephone installation in any subway in the world. The system was worked out according to designs of the New England Telephone and Telegraph Company, which provides all the service for both the public lines and private wires of the Boston Elevated Railway Company, which company operates the tunnel. There are eight stations in the tunnel, in which are located a total of twenty-four pay-stations for public service and eight private instruments for railway service. Each booth is equipped with standard pay-station sets of the three-slot type, and special precautions have been taken to render both the booth and its equipment sanitary in every respect.

The first month's operation showed a total of 6,232 metropolitan and suburban calls, giving an average of 195 calls per day for the twenty-four stations. It is expected, however, that the traffic will increase as the public becomes more familiar with the use of the tunnel and with the telephone facilities offered.

TRUNK LINE LOADS FOR HYDROELECTRIC PLANTS.

BY ALTON D. ADAMS.

Railroads, like rivers, run twenty-four hours per day, and the most economical source of energy for the electric operation of the former will probably be found in the latter.

It is notable that many of the long interurban electric railways are today operated in the main with waterpower, as is the case between Springfield and Worcester, Mass., between Saratoga Springs, Schenectady and Albany, and between Buffalo and Rochester, N. Y.

One important difference between the interurban electric roads and the trunk lines lies in the fact that the latter haul a great share of both their passenger and freight traffic during the night, while the former do much the larger part of their work during the day, and nearly all of it before midnight. Trunk-line roads may thus be expected to use waterpower more hours per day than the present interurban railways, when the former are electrically operated.

In fact there is hardly any time of day on a long trunk-line road when a large percentage of the maximum power is not wanted, and this maximum is said to be in demand about three hours per day, while the maximum lighting demand continues during hardly more than one hour daily.

Very few hydroelectric systems, even among those that have a large industrial load, are able to show more than a small fraction of the twenty-four-hour output for the night run. According to the records in hand of one hydroelectric system, which had an output of nearly 200,000 kilowatt hours from 6 a. m. on one day to the same hour of the following day, about eighty-five per cent of this output was delivered between the hours of 6 a. m. and 6 p. m., leaving less than fifteen per cent for the following twelve hours.

With more than one-half of the total freight traffic and of the through passenger traffic moving over the trunk-line roads at night, their electric operation with waterpower will utilize a large part of the inner discharge that now goes to waste.

These considerations make it appear that energy for the operation of trunk-line roads can be generated by hydroelectric stations at very low rates. As the more important waterpowers along each river and on adjacent rivers are being rapidly connected by large transmission systems, it is probable that the trunk lines must eventually draw much of their energy from these systems, if water is to be the source.

One objection to this suggestion, and probably the most important, is the possible difference between the current frequency of the generators in the hydroelectric plants and the frequency for which the single-phase motors of electric locomotives should be designed for the best results.

The standard frequencies of twenty-five and sixty cycles per second now obtain in the great majority of large hydroelectric plants, and the requirements of present lighting and power loads appear to make it imperative that both of these frequencies be continued during some years to come, at least. In the greater and increasing number of the large hydroelectric systems, however, the frequency is twenty-five rather than sixty cycles.

On the other hand it appears to be quite certain that the requirements of motors designed for electric locomotives can best be met with not more than twenty-five cycles, and perhaps with only fifteen or even ten per second.

If twenty-five-cycle current becomes the standard for trunk-line work, the greater number of hydroelectric systems will be able to supply the required form of energy from their regular generators, but even in this event some large systems can serve the railroads only by the transformation of sixty cycles, or by the installation of new generators.

Should it transpire that heavy railroad work must be done with current of ten or fifteen cycles per second, then existing hydroelectric systems must either transform a part of their outputs to the lower frequency, or else provide additional generators, if they are to carry this load.

It thus appears that at least a part and perhaps all of the hydroelectric systems must invest in new generators or in frequency changers, if they are to deliver current for the operation of the trunk lines, and the question is, will this pay? Of course, the railroads may install the necessary frequency changers, but then the rates for power must be reduced accordingly.

Remembering that the investment in electric generators is only a moderate percentage of the total in a hydroelectric system, that most of the interurban roads are now operated with current that is both transformed and converted, that the trunk-line load will be very large, and that its load-factor remains at a comparatively high figure during the entire night, it can hardly be doubted that it will pay the hydroelectric plants to operate the railroads. As waterpower is cheaper than steam power, particularly during the night, hydroelectric plants can serve the trunk lines at attractive figures, and it is not to be expected that the railroads will generate power at far higher rates than it can be purchased.

Thus far the hydroelectric plants have been able to secure all classes of loads that have been within their reach, including the steam-driven central station, the factory, the chemical works and the interurban railway; can it be doubted that the trunk lines will follow?

Westinghouse Company Starts Year with Cash Balance of $13,000,000.

The Westinghouse Electric and Manufacturing Company starts the year under very favorable conditions. Its total cash balance December 31, 1908, aggregated $10,902,338. Including unpaid balance on stock subscriptions of $2,436,340, the total cash balance on December 31 was $13,248,677.

The company has just sent out checks for $562,725, representing interest due on bonds, debentures, etc., set aside $500,000 due to the sinking fund on December 31, 1908, and paid $220,000 in settlement of sundry debts, preliminary to the opening of a new balance sheet.

The company is now in a very strong position, a great deal of the credit for which is due to George Westinghouse, who was largely instrumental in raising $17,785,000 necessary to the discharge of receivers.

Allis-Chalmers Business Shows Improvement.

Operations of the Allis-Chalmers Company for the first six months of the current fiscal year have averaged between sixty-five and seventy per cent of its capacity, and the output as compared with the same period last year showed a decrease of from twenty-five to thirty per cent. The percentage of operations and output are increasing, however, and the indications are that an excellent showing will be made for the year.

The company reports that the volume of business booked during the first half of the fiscal year 1908 and the same period this year were about the same, but, it is pointed out, the trend was in opposite directions.

Conditions Affecting Stability in Electric-Lighting Circuits.

233D MEETING OF THE AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS, NEW YORK, JANUARY 8.

The 233d meeting of the American Institute of Electrical Engineers was held in the Engineering Societies' Building, New York city, Friday evening, January 8.

The secretary announced that 114 associates had been elected at the afternoon meeting of the board of directors, and the following transferred to full membership: Remigio Jimenez, Havana, Cuba; Samuel Lindzey, Pittsburg; W. G. Carlton, New York; S. D. Sprong, New York; George W. Patterson, Ann Arbor, Mich.

President Ferguson called upon Prof. Elihu Thomson to present the paper, "Conditions Affecting Stability in Electric Lighting Circuits," and said the Institute was especially fortunate in having been able to induce so distinguished a member as Professor Thomson to present this paper. A full abstract of this paper is begun elsewhere in this issue.

The discussion was opened by the reading of a communication from Dr. A. E. Kennelly, read by C. F. Scott. Dr. Kennelly analyzed several portions of the paper and called attention to the curious fact that the property of diminution in resistance with current, which may bring about current instability in an arc circuit is the property which is utilized in wireless telephony to throw a vertical conductor into sustained electric oscillation, by means of voltaic arcs shunted by condensers.

A communication from Alex Dow was read by H. H. Barnes. Mr. Dow described several instances where both line and generator characteristics had contributed to instability. The worst case, in his experience, of current instability, was that of several circuits each intended to carry 150 arcs which behaved so badly that he was called in as an expert adviser to suggest a quick and cheap remedy. The generators had not the drooping characteristic. Their short-circuit current was about twice the normal current. But they had an exceedingly effective regulator which would control closely the current supplied to a circuit naturally stable. The constructing engineer had combined those machines with shunt-wound arc lamps—not the lamps usually operated in conjunction with these generators. Each string of 150 lamps was served by underground cables, rubber-insulated, lead-covered, of high insulation resistance, high static capacity, and inadequate resistance to puncture. The capstone, so to speak, of the combination was that the lead cover of each length of cable was intentionally kept out of contact or connection with the lead covering of the succeeding lengths and was, because of frozen soil, practically insulated from earth.

When these 150-light circuits were operating all the telephones on the west side of that large city went out of business. But the circuits would not stay in operation. The machines spilled, the cables punctured, and the arc-lamp posts burned out. The remedies applied were, first, the earthing of each section of lead sheath; secondly, a rearrangement of the circuits so that some old differential lamps were included in each string of shunt-wound lamps; third, the steadying of the machines by various devices known in the art, and finally the substitution of different machines having a marked drooping characteristic for the original very efficient, but very touchy generators. The last remedy was, of course, final, but the effect of the connection of a comparatively few differential lamps was surprising.

Dr. E. W. Rice, Jr., paid a tribute to Professor Thomson for the splendid work he had done in the early days of the development of arc generators. Professor Thomson had, with characteristic modesty, failed to call attention to the fact that the first scientific investigation of the properties of the electric arc were made by him with, Dr. Rice believed, the assistance of Professor Houston, some time in 1878 or 1879, and that a paper setting forth the result of the investigation was published in the Franklin Institute Journal at the time. This paper clearly sets forth, among other interesting facts, the laws governing the variation of the resistance of the electric arc as an inverse function of the current, from which the inherent instability naturally follows. He continued:

"My first intimate acquaintance with the Thomson-Houston arc lighter was made with a thirty-light machine in the latter eighties, in the middle of the Mississippi Valley, at a place where repair parts were unknown. A sleepy attendant allowed the lubrication of the glower to become defective, the runner stuck in the case, and the glower case was torn from its bolts, with a mess of wreckage of the links and levers of the regulator mechanism. The accident resulted in maledictions, but it was no fault of the machine; and to show the essential simplicity of the type, I will say that new bolts and some links and levers roughly shaped from iron rods by the aid of a blacksmith's forge, put the machine into satisfactory and prompt commission, and it was continuously used while new parts of orthodox construction were being obtained from the factory in the East.

"My observation of that machine and many others of the same or larger size, has led me to view the function of the glower (at least under some conditions of the load) a little differently from the manner stated in the paper. I differ with Professor Thomson, with much diffidence, and the difference, after all, may be only a matter of definition."

Prof. D. C. Jackson said that it is even now not generally understood that the limited theory of dynamo-electric machinery, which is sufficiently comprehensive, to explain the performance of constant-potential direct-current machines requires extension and generalization to apply suitably to the series are machines. Continuing, he said:

"For instance, in viewing the magnetic flux entering the armature of a direct-current constant-potential machine, we think of the aggregate flux as a determining feature of construction and operation. In the case of alternating-current machines, we recognize that the positioning of the flux with respect to polar faces and arrangement of the armature conductors, affects the form of the pressure wave, and the output and functioning of the machine. A like condition seems to be even more marked, in case of the Brush arc-light machine, and the positioning of the flux which enters the armature core may be of as great importance as the aggregate strength of field. As one instance, I will say that it is my information that changing the polar tips from soft steel to cast-iron of certain Brush machines actually increased the capacity of the machines. There are machines in which armature coils are changed from series to parallel relations, and the reverse, by the action of the commutator in each revolution of the armature. A rational theory includes such effects; and its guiding finger points to such improvements as the reduction of copper used per kilowatt of capacity referred to in the paper."

Mr. C. M. Green said that the point of commutation in the Brush machine not being midway between the pole-pieces, but

considerably drawn over, is practically the keynote of all our arc machines today. Under poor load condition, the point of commutation is on the following pole-piece, and as the load is decreased, or the lamps are cut off, the point of commutation goes still further and further to the following pole-piece.

H. G. Stott and J. B. Taylor continued the discussion, and Dr. Charles P. Steinmetz was then called upon. Dr. Steinmetz said that the unstable electric circuit discussed in Professor Thomson's paper has a significance far beyond the arc circuit. The electric arc is merely the first and therefore the best-known type of unstable electric circuits, but instability occurs also in other electric systems, and mechanical systems and still other systems where the conditions are of the same nature. So we find synchronous and induction motors drop out of step; we find such motors starting and failing to run up speed. We find surging and hunting of synchronous converters. We find electrical apparatus apparently misbehaving at the end of very long transmission lines. We find in all this phenomena, the same characteristic of instability, and if we look into it, we find the same causes, the same relations as have been so ably investigated in the early days by Professor Thomson and his co-laborers in the arc circuit, and even an engineer who has nothing to do with arc lighting must realize the vast importance of the problem of studying stability and instability of electric circuits. After some cause and effect is produced, this effect may be in opposition to the cause, or may assist the cause. Now, if the effect is in opposition to the cause, then it reduces the cause, and thereby itself; that is, limits itself to the conditions which are stable. If, however, the effect is in the same direction, or assists the cause, it is cumulative and the conditions are unstable. As a corollary of the law of conservation of energy, we know the effect must always be in opposition to cause, and the system stable. This, however, does not apply outside of the field of energy. For instance, in an electric arc, on a constant-potential system, in the alternating circuit, the current depends on what is produced by the resultant electromotive force acting in the circuit, increases the current in the alternating arc, reduces the voltage consumed by the arc and thereby increases the resultant electromotive force, the difference between supplied voltage and voltage consumed by the arc, thereby increasing the current.

The questions of stability or instability of electric or other systems always refer to two conditions, the circuit or system which is unstable, and the conditions under which it is unstable. Now, we must look into the induction motor carefully. We speak of the lower part as the unstable branch, and the upper part as the stable branch. In reality that applies only to the load requiring a constant torque, independent of speed, as pumping against a head of water, assuming the load driving a ship's propeller. The torque has a constant value at standstill, and all the curves intersect at a single point, and the whole induction-motor curve is available. You get the same condition as in the arc in a constant-current system, a single point of intersection.

If a load requiring a torque which is proportional to the speed is considered, as, for instance, driving an electric generator at constant excitation feeding into a constant resistance, as approximating into a like resistance. Then the voltage of the generator and drop of current is proportional to the speed, while the field excitation is constant.

This relation applies to induction apparatus, and it is frequently noticeable and becomes serious under certain conditions on polyphase induction motors. They are more marked on single-phase induction motors, and quite frequently marked on starting the synchronous motors from alternating polyphase supply, as induction machines. The synchronous machines will start all right from rest on alternating voltage, but hesitate at half synchronism, and it requires a higher supply voltage to get the machine up beyond the intermediate speeds, that drooping part of the characteristic, and run it up to synchronism.

Professor Thomson in closing the discussion said, in reply to a question by Mr. Stott, that when a patent was first applied for on a three-coil machine, it was illustrated in the patent specification with a commutator and with slip-rings, but the Patent Office would not recognize that that machine could be used with slip-rings, and the argument was finally given up, and the patent for the commutator segments and no slip-rings was taken out. If it had been shown in the specification, the slip-rings, of course, it would have been an alternating three-phase machine. It was shown, but that matter was removed. In 1881, in New Britain, experiments were made with a machine which had slip-rings. The terminals of the machine were carried through three slip-rings, in addition to the commutator. The object was to control the flashing of the machine by putting condensers between the commutator segments, and to do that the slip-rings were carried out to connections outside. It was found that the condensers would not live, but go off in a flash. At the same time high-frequency effects on the condensers were noticed, that is, a burning of the wire leading to the condensers, sparks going between the turns instead of going around.

The Coal-Mining Industry in 1908.

From reports received by the United States Geological Survey it might be inferred that a most effective method of conserving the coal resources of the country is to develop a financial panic, for one result of the depression that followed the panic of October, 1907, appeared in decreased production of coal in the United States in 1908—a decrease of fifteen to twenty per cent as compared with the production of the preceding year.

In 1907 the production reached the unprecedented total of 480,363,424 short tons, of which 394,759,112 short tons were bituminous coal and lignite and 85,604,312 short tons were Pennsylvania anthracite. Letters received from state officials and others closely in touch with the coal-mining industry in the several states indicate that the bituminous coal production in 1908 was between 320,000,000 and 330,000,000 tons, or practically 70,000,000 tons less than in 1907.

The railroad shipments of anthracite in 1908 amounted to 71,945,525 tons, compared with 75,162,510 tons, in 1907, indicating a decrease in the total production of anthracite of 3,580,000 tons.

In the bituminous regions the effects of the panic were most seriously felt in the coking branch of the coal-mining industry, the principal coke-producing centres reporting a decrease in output amounting to nearly fifty per cent.

Nernst Lamp Efficiency.

In reviewing the incandescent-lamp situation on page 5 of the issue of January 2 a printer's error introduced the word "low" instead of "high" in speaking of the efficiency of the Nernst lamp. The statement should have read, "Not only is the efficiency high," etc.

THE WINTER SLEET STORM AS A DESTROYER OF AERIAL LINES.

BY CLARENCE MAYER.

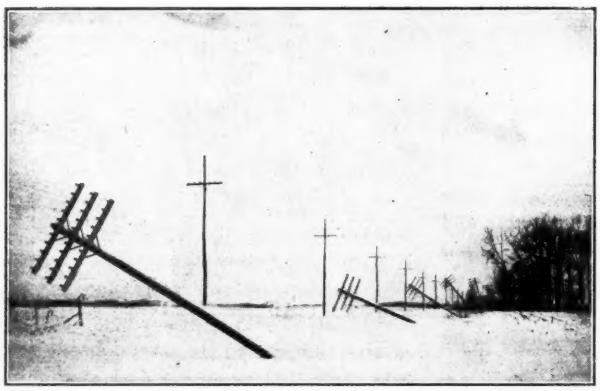
That a prosperous telephone company may in a few hours be almost put out of business—with practically no exchanges in operation and no toll connections—seems hard to realize by one not familiar with the damage wrought by a winter sleet storm; but, that it is possible could be made clear in no more striking manner than by the accompanying illustrations.

While the damage done to many of the lines shown in the illustrations might be indirectly attributed to overloading, in the case of a company whose growth has been rapid such conditions are difficult to avoid, because it is not always possible for the shrewdest engineer to make a close or even an approximate estimate of the future demand for service. This may be readily seen when we consider that in many cities, districts which were thinly populated have become densely populated in a short time by the extension of an elevated road or a trolley line or by the activities of a "home" builder. In such districts existing lines are often overloaded to supply immediate demands for service.

Of course, in the case of toll lines or main lines, underground installation of heavy leads is the remedy for overloading, but many things may prevent this being done. The length of franchise may not justify the expenditure, or the money for such installation may not be available.

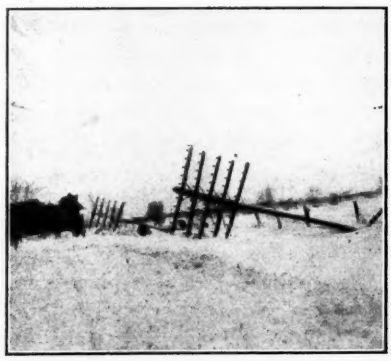
It is the general practice of companies maintaining a plant which covers a large territory and operating a large number of exchanges to divide the territory into districts, with gangs, repairmen and installers in each district under the supervision of a district wire chief whose headquarters are in the largest exchange in that particular district, and it is usually a very easy task with the facilities at hand to clear local or toll trouble as it develops and without much interruption of service. Of course there are cases where a main cable is suddenly put out of service and men and material to assist in its immediate repair are required from the general headquarters or from neighboring districts, but these cases are comparatively rare.

"A"—SEE "B," WHICH IS THE SAME LINE TWENTY MINUTES LATER.



"B"—SEE "A," WHICH IS THE SAME LINE TWENTY MINUTES EARLIER.

"C"—SEE "D," THE SAME LINE ONE-AND-ONE-HALF HOURS LATER.



"D"—SEE "C," SAME LINE ONE-AND-ONE-HALF HOURS EARLIER.

It is interesting to note the demoralizing effect of a severe sleet storm on a system of this kind, for while precautions are taken at the general offices of the company to get in touch with the conditions in each district when a sleet storm is in progress, or when symptoms show the immediate approach of a storm, it is sometimes impossible to get into communication with the district wire chiefs to secure a general idea of the extent of trouble on account of the complete tie-up and interruption of toll and telegraph service. The storm after which the accompanying photographs were taken is a case in point.

Commencing late one Saturday night and continuing all day Sunday during the early part of January of last year a wet snow and sleet storm, accompanied by a high wind, seriously crippled the toll and local service of a large telephone company operating in the middle section of this country.

The fact that this occurred on Sunday, coupled with the fact that the outside construction force was greatly reduced on account of a retrenchment policy, somewhat handicapped efforts to cope with the situation. Precautions had been taken by the superintendent to get into communication with the outside force and instructions were given to district wire chiefs to keep informed of the conditions in their respective districts and report promptly every hour by telephone to the main office and in the meantime to round up construction and repair gangs and be in readiness at a moment's notice.

A toll test made early Sunday morning showed only scattered wire trouble, with nothing serious on any route, but by noon the same day, poles and wires were down in every direction, and a number of exchanges out of communication. The district wire chiefs dispatched men over the

routes in their respective districts and, with the assistance of help from headquarters, the entire territory was covered and a general idea of the extent of damage was obtained.

It was found that the outer exchanges escaped with very little trouble, but that the wires on nearly all the routes within a radius of thirty miles of the main exchange bore a heavy coat of ice from one to two inches in thickness, and the resulting strain of the weight and whipping of the wire by the wind was breaking poles and wires at various locations.

A summary of the amount of damage up to midnight Sunday showed that 137 poles went down on the main toll lines.

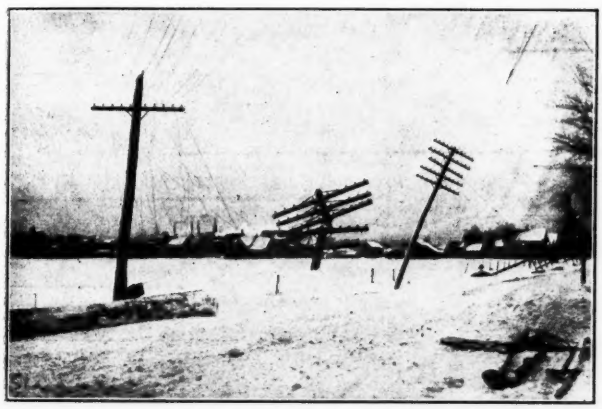
A toll test at this time showed 236 circuits entering the main exchange out of service; 109 short local circuits, connecting smaller exchanges, out of service, and eighty-five poles down, and 4,282 subscribers' stations out of service.

and clerks were kept busy continuously from Sunday morning until early Monday morning. Some were sent out with gangs collected in districts that were not affected, the gangs having been notified to meet certain trains and others remained at their desks answering calls for material and arranging for its immediate shipment to the points where the gangs were waiting for it.

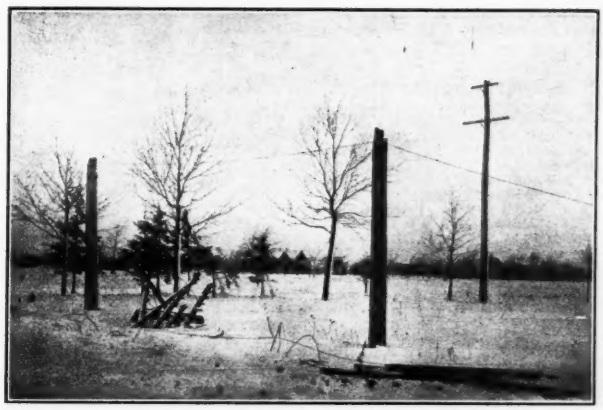
SLEET STORM AS A DESTROYER OF AERIAL LINES.

All efforts were first concentrated on the toll lines. Instructions were issued by the superintendent of construction to clear the roadways of broken poles and obstructions and get the toll circuits working temporarily. In accomplishing this gangs were started from both ends of a route and worked until they met. They were then shifted to other locations. Road conditions, where there was a heavy snowfall, prevented as rapid a progress as was to be expected. Traveling through drifts of snow from six to eight feet in depth and mud only covered by a light crust of frozen earth thoroughly exhausted teams in a remarkably short time.

The emergency cable was shipped to points where pole breaks were severe and laid along the ground or erected on pole stumps and trees so that by 6 o'clock in the evening the day following, all cable was spliced up by the cable splicers. This permitted communication over one-half of the toll circuits which were reported out late Sunday night.



SLEET BRINGING DOWN THE POLES, RIGHT AND LEFT.



COMPLETE BREAKDOWN AFTER SLEET STORM.

In addition to the pole breaks, hundreds of poles were leaning badly, crossarms pulled out of line, anchors broken and, in some cases, high-tension lines were down with wires dangling among the telephone wires, creating a dangerous situation.

The telegraph and long-distance telephone lines were down in many places and business was paralyzed, railroad trains were late, street cars unable to run and the ground covered with ice, making footing dangerous for men and horses.

Arrangements for the immediate shipment of emergency cable and wire to close the worst breaks were made, and the foremen were successful in securing a sufficient number of men in their immediate locality, most of whom were employes who were laid off in the general reduction in the fall.

The general office force was sent for

SLEET STORM DAMAGE.

In some instances heavy toll lines carrying from three to six arms of copper toll circuits were broken off at the butt and lying across the roadways. These lines were given immediate attention in order to prevent interference with traffic, and also in order that the copper wire could be gathered to prevent its theft.

A break of forty-seven poles on a heavy main toll route paralleling an underground conduit route in which cable had been partly installed was quickly put into working order by splicing up a sufficient number of pairs of conductors of the cable installed in the underground route to meet the demand temporarily.

Until Wednesday noon when a perceptible rise in the temperature melted most

of the ice from the wires, efforts to clear wire trouble were particularly discouraging on all lines. Circuits cleared through each day would go out as did others at different locations, and the gangs were simply obliged to patrol back and forth over the routes clearing up all trouble behind them. Efforts to prevent further trouble by shaking the ice from the wires were futile, as this method invariably broke the wires. Wire trouble was largely found near a running transposition, where the weight of the ice brought the wires close to each other and they froze together.

A total of approximately 4,500 subscribers' telephones were out of service on Monday noon, due to broken poles, wires and drops, but as the department's entire force was concentrated on the toll repairs, assistance could not be given to the exchange service until Wednesday at noon. On Wednesday morning there were 2,180 exchanges out of service; on Thursday, 989; on Friday, 345.

The remaining trouble was practically cleared up by Saturday night, with the exception of one or two exchanges, where a small amount of serious trouble was remedied later. Fortunately very few burn-outs occurred, nor was any serious cable trouble found.

The total cost of temporary and permanent repairs to entire exchange and toll plant was nearly $60,000.

Interborough Pays $475,916 Fee.

Controller Metz, of the New York city government, has received from John H. Campbell, treasurer of the Interborough-Metropolitan Company, of New York, two checks in payment of the Interborough's regular annual assessment for the sinking fund, which is to be used eventually to amortize the bonds issued for the construction work on the New York Subway. The first check, in payment of charge against contract No. 1, was for $441,112, and the second, payment on contract No. 2, the Brooklyn line, was for $34,804.

Telephones for the Turkish Empire.

Telephones are to be introduced into the Turkish Empire and operated by the government on the same plan as the mail and telegraph services. It is believed that sooner or later the government on this point will yield to private enterprise.

The Faraday Society.

At the fortieth ordinary meeting of the Faraday Society, December 21, with Dr. N. T. M. Wilsmore in the chair, E. A. Ashcroft, A. M. I. C. E., M. I. E. E., read a paper on "The Influence of Cheap Electricity on Electrolytic and Electrothermal Industries."

The extent of future developments of electrochemical industries, he pointed out, will depend on the limits to which the cost of electric energy can be reduced at suitable sites. In most cases an industry only becomes economically possible when the price of power has been reduced below a certain point, which varies more or less for every electrochemical industry. The author discussed, in particular, the lowest possible limits of cost for the production of electricity from waterpower, with special reference to the conditions such as exist today in Norway.

Some industries (the smelting of iron, the manufacture of lime nitrogen, and the complete treatment of complex sulphide ores may be instanced), to be worked commercially, will require a supply of energy at a cost of about ten dollars per kilowatt-year, and this "low-grade limit" in the opinion of the author can only be obtained from waterpowers whose natural conditions enable the development and regulation of power at a very low expenditure of capital—of the order of thirty-five dollars per electrical horsepower of capacity, including all necessaries up to the dynamo terminals. The author estimates the corresponding figure at Niagara to have been not less than $150. The powers of this class are not very numerous, and their natural advantages will to some extent be neutralized by the values placed on the water rights, but many examples exist, and the author gives full particulars of the cost of developing a concrete case in Norway of 7,500-kilowatt capacity. This fall cost $37 to develop and equip, and current can be sold at $12.50 per kilowatt-year. It should be mentioned that at Meraker 3,000 horsepower has been sold for $8.50, and at Notodden (also in Norway) for $9.25 per kilowatt-year.

The second best sources of energy in bulk today are those waterfalls where a high cost of regulation or development is necessary to bring the water to the place of consumption and to ensure an even supply all the year round. From these falls electricity can be sold for about $26.50 per kilowatt-year.

In a communication to the society W. R. Cooper pointed out that the cost of waterpower was frequently what it would fetch, and that it could not be likely to have a fixed value. The price of waterpower tended to rise, that from other sources tended to fall; waterpower should, therefore, be purchased outright by the consumers and not merely leased. Bertram Blount referred to the possibilities of electric zinc smelting as one of the industries requiring cheap power for development.

During the discussion it was shown that the Niagara plant had been designed for a far greater output than had up to the present been reached, and L. Gaster directed attention to the fact that, therefore, the limit of cost of production of power was far below the figures at present obtaining.

Public Service Commission Rejects Plan for Steinway Tunnel Purchase By New York City.

The rejection of the proposition for New York city to purchase the Steinway Tunnels has been unanimously concurred in by all the members of the Public Service Commission. The proposition was first made last February by the Interborough Rapid Transit Company. The Commission at that time did not possess the necessary authority to consider the proposition, but the Legislature shortly after passed an act amending the rapid-transit law, conferring the necessary authority on the Commission to purchase any lines of railway already constructed or in process of construction which might be constructed as a rapid-transit railway. It was presumed that this amendment was intended to apply only to the Steinway Tunnels. The tunnels consist of two single-track tubes, beginning at a loop at Forty-second Street and Park Avenue, Manhattan, running thence under Forty-second Street, East River, Man-o'-War Reef, to Long Island City, and thence under Fourth Avenue to East Avenue, where there is a terminal loop. The tunnels were built by the New York & Long Island Railroad Company, the stock of which is now practically all owned by the Interborough Rapid Transit Company, which furnished most of the funds to build the line. The Interborough Rapid Transit's proposition included the transfer of all its interest, title and control in the tunnel property to the city of New York, at its actual cost, estimated at $7,239,476, payable in four per cent city bonds at par.

TELEPHONES FOR FIGHTING FOREST FIRES.

BY W. H. RADCLIFFE.

During the fiscal year ended June 30, 1908, 3,500 miles of telephone lines were constructed in the national forests, so that fires starting there could be promptly reported and extinguished.

This action on the part of the national forestry commissioners was timely and valuable in view of the almost unprecedented conflagrations which since then have threatened to destroy much of the valuable woodland of the United States.

The origin of forest fires is always an interesting problem and often a perplexing one. So far as information is obtainable, forest fires are due to many and varied causes. In New York state, for example, where, during the past year there were over 700 forest fires, the causes were reported as follows: Hunters, 103; campers, 27; fishermen, 18; clearing land, 19; incendiary, 48; berry pickers, 12; children, 6; burning buildings, 1; lightning, 9; blasting, 2; miscellaneous, 47; railroad locomotives, 85 serious fires, and over 300 incipient ones, which were extinguished without serious damage.

According to Dr. W. J. McGee, erosion expert, United States Department of Agriculture, the aggregate loss from forest fires in all parts of the country during the months of conflagration is close to one million dollars a day. Taking into consideration the loss of this timber for building purposes and fuel, the loss of its foliage for replenishing oxygen to the atmosphere and the arrested development of river streams which this great devastation of our forests entails—streams upon which we rely each year more largely for power, for soil preservation and for otherwise supplying the necessities of life—the seriousness of the situation assumes alarming proportions and places grave responsibilities upon those states, counties and towns which have not as yet done anything toward solving the problem of locating and fighting forest fires.

Further argument is unnecessary to show that the great loss suffered each year through forest fires is a serious hindrance to our national prosperity. That this loss could be largely prevented is proven by the successful efforts made during the past few years by the national forestry commissioners. Only a comparatively small proportion of the forested area of the United States, estimated at 168,000,000 acres, is under their control, and if all the forests are to be saved, state, counties, towns, corporations and private individuals must co-operate with them. Among the states which have taken active steps toward organizing forest-fire-fighting departments are New Jersey, Pennsylvania and New York. New Jersey claims the distinction of being the most advanced in this respect, chiefly on account of its department being organized to look after all woodlands, irrespective of ownership.

FIG. 1.—UNITED STATES FOREST SUPERVISOR USING A WESTERN ELECTRIC PORTABLE TELEPHONE TO REPORT A FIRE IN THE NATIONAL FOREST.

The following table, taken from the New Jersey state records, gives a summary of the forest fires occurring in that state during past years and shows that although the number of such fires has considerably increased of late, the area burned and the estimated damage done has greatly decreased, owing to the higher efficiency of its forest-fire-fighting department.

It will be noted from this table and from the statistics previously given from New York state that railway locomotives are the most dangerous of the several causes responsible for starting forest fires. Efforts are now being made to have the railways co-operate with the Forestry Service in clearing each side of the track where the track passes through woodlands and instructing the track walkers and train crew to report to those in the employ of the forestry commissioners any fires which they themselves are unable to extinguish and to render assistance in fighting these fires whenever possible.

The regular and volunteer forces employed for fire fighting in the national forests number about 200,000; of these, a large percentage are employes of great lumber companies and railroad systems, stockmen, stock-herders and every holder of use-permits in the national forests, with all dependents—all of them ready to serve at a moment's notice from the United States forest supervisors.

During the summer months, when destruction by fire is greatest, 1,351 rangers and guards are employed by the forest commissioners to patrol the national forests. Each of these men is required to protect an area of 121,506 acres—an area much too large to be thoroughly covered by one man, but governed by the appropriation of funds. The rangers, mounted on horseback and provided with portable telephone sets, traverse the national forest, and whenever a dangerous fire is sighted notify the forest officers of the fire over the telephone lines. As soon as fire is thus reported, fire fighters are rushed to the burning region.

During the last fiscal year 160 miles of road and 3,300 miles of trail were built for use by the rangers and to facilitate the massing of large forces of men at advantageous fire-fighting points, and the

SUMMARY OF FOREST FIRES FROM NEW JERSEY STATE RECORDS.

Year.	No. of Fires.	Acres Burned.	Acres per Fire.	Estimated Damage.	Damage per Fire.	Causes.					
						Locomotives.	Brush Burning.	Smokers.	Incendiary.	Miscellaneous.	Unknown.
1872	....	100,000	.....	$1,000.000	.....	.....	.....	.....	.....	.....	.....
1880	54	71,074	1,316	252.240	$ 4.671	28	7	.....	7	12	.....
1885	.....	128,000	.....	1,128.000	.....	.....	.....	.....	.....	.....	.....
1895	49	66,120	1.349	600,000	12,245	24	6	4	4	5	6
1902	65	98,850	1,520	169,323	2,605	21	22	4	2	12	4
1907	167	11,525	69	11,647	70	60	7	1	10	19	70

interesting illustration in Fig 1 shows a United States forest supervisor reporting a fire by means of a Western Electric portable telephone set, in the Shoshone National Forest, which lies in the northwestern part of Wyoming. In this case the telephone set was hung on a tree and short wire connections were made with the line wire and ground. A call was thus sent to Cody, Wyo., about forty miles distant, and help was received more than a day sooner than if the message had been carried by man. This fire started an hour or two before it was discovered and burned over 1,500 acres of heavy timber land before it was under control, but the loss was small compared with what it would have been if a telephone had not been used.

The telephone line consists of a single galvanized wire supported on glass insu-

FIG. 2.—WESTERN ELECTRIC PORTABLE TELEPHONE SET EMPLOYED BY THE NATIONAL FORESTRY COMMISSIONERS FOR FIGHTING FOREST FIRES.

lators, which are mounted on a substantial pole line. Ground rods at every tenth pole or thereabouts provide suitable earth connections for the portable telephone sets, the other terminal of the sets being temporarily connected with the line wire.

All of the telephone sets now in use by the national forestry commissioners for fighting forest fires have been supplied by the Western Electric Company. They are of a type specially designed and constructed for the purpose and have given entire satisfaction.

One of these portable sets is shown in Fig. 2. The case is handsomely finished in birch or mahogany, and is provided with a strap to facilitate handling. It contains a buzzer, hand generator, switch, receiver cord, one dry battery, induction coil, a transmitter and a receiver.

The transmitter is fastened inside of the case and the receiver and the other projecting parts are mounted so that they are not liable to be caught by branches and thus handicap the carrier. The compactness of the set, it being only eight by six by five inches, makes it easy to handle.

The set is connected in circuit, as previously explained, by joining one of its terminals to a leader brought down from a telephone line, and its remaining terminal to ground.

An Early American Tungsten-Lamp Inventor.

Denying that the Germans were the original inventors of the tungsten high-efficiency incandescent-lamp filament, although according them credit for its careful development, Mr. John A. Yunck of South Orange, N. J., in a communication to *Electrochemical and Metallurgical Industry,* says:

"It has not been generally known that a young American, while still in his teens, was the inventor; Mr. Turner D. Bottome, who, by the way, was an exceedingly bright electrochemist and contributed a number of electrochemical inventions to the world.

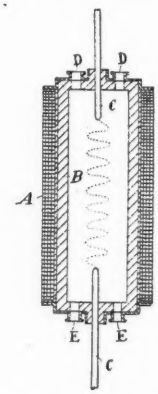
"In the early part of the year 1887 Mr. Bottome, scarcely eighteen years old, became associated with a lamp company in Harrison, N. J., called the Vitrite Aluminoid Lamp Company. Being a great student and observing the defects of the filament made by the company with which he was connected, he conceived the idea that the metal tungsten had properties of peculiar advantage for an incandescent-lamp filament, a metal of fairly high resistance and of very high fusing point. During the process of the invention some men made strong efforts to get the invention away from him, and Mr. Bottome would have lost it but through the effort of the late John B. Tibbits of Hoosick, N. Y., who came to his aid and, after the patent was allowed, paid a handsome sum for it. Mr. Bottome's application was filed September 29, 1887, and allowed April 9, 1889; it is No. 401,120. He also took out a patent for treating the filament, dated August 6, 1889, No. 408,-286. Another patent of his relates to a molybdenum filament.

"Mr. John B. Tibbits, who took up this young man, was an Episcopal clergyman of considerable means and a man of very bright ideas and quite an inventor himself. He spent a large sum of money on electrical research work. This appeared to be a hobby of his, and he took great comfort in his work. Some of his suggestions were thought visionary at the time, but some of them have since proved perfectly feasible."

Thus it appears that the invention of the first tungsten lamp was made by an American in Harrison, N. J., today the site, by the way, of one of the largest lamp factories in the world.

Nitrogenous Products Furnace Employing Rotating Helical Arc.

Kristian Birkeland, of Christiania, Norway, who has been associated with the development of the well-known Birkeland-Eyde process of extracting nitrogen from the atmosphere, perhaps the only commercially successful direct-combustion process of record, was recently granted an American patent on a new form of furnace. Unlike the former type, brought out by the Norwegian experimenters, in which alternating-current, high-tension arcs were rapidly formed and blown into a veritable disc by traversing a powerful unidirectional magnetic field, the present



NITROGENOUS-PRODUCTS FURNACE EMPLOYING ROTATING HELICAL ARC.

furnace presents the flame to the air in the form of a rotating helix.

As shown in the accompanying drawing, the arc electrodes are placed axially at the ends of a comparatively long cylinder of refractory material. Around the cylinder is placed a winding, shown in cross-section in the sketch. The electrodes C project through openings in the iron heads into the furnace. Air may be blown into the chamber through openings D at one end, and the products obtained are taken out through openings E at the other end. The field is created by means of a coil A surrounding the furnace casing, supplied by either direct or alternating current.

The arc is started by approaching the electrodes to each other; when again separated the flame will take a form as indicated and violently rotate within the furnace, thereby also causing the air to rotate, so that a very intimate contact between the air and the flame is secured.

FINANCIAL REPORTS OF ELECTRICAL COMPANIES.

KANSAS CITY RAILWAY AND LIGHT.

The report of the Kansas City Railway and Light Company for the month of November and six months ended November 30 compares as follows:

	1908.	1907.
November gross	$ 543,513	$ 518,424
Expenses	300,965	276,030
November net	$ 242,548	$ 242,394
Charges and taxes	153,899	151,099
November surplus	$ 88,649	$ 91,295
Six months, gross	3,232,638	3,166,071
Expenses	1,826,144	1,620,218
Six months, net	$1,406,494	$1,545,853
Charges and taxes	931,252	924,565
Six months, surplus	$ 475,242	$ 621,288

AMERICAN TELEPHONE EARNINGS.

The American Telephone and Telegraph Company reports earnings for the month of November and eleven months ended November 30, 1908, compared as follows:

Month November—	1908.	1907.
Receipts:		
Dividends received	$ 729,570	$ 634,965
Interest and other revenues.	794,931	809,770
Telegraph traffic (net)	494,168	437,958
Real estate	13,994	*2,061
Other sources	58,182	69,636
Total	$2,090,845	$1,950,268
Expenses	169,390	164,694
Net earnings	$1,921,455	$1,785,574
Interest	638,868	681,578
Balance for dividends	$1,282,587	$1,103,996

*Debit.

January 1 to November 30:		
Dividends received	$13,280,127	$11,805,167
Interest and other revenue.	8,882,006	7,550,130
Telegraph traffic (net)	3,967,662	3,582,601
Real estate	149,510	71,578
Other sources	706,090	389,655
Total receipts	$26,985,396	$23,399,181
Expenses	1,905,449	1,529,502
Net earnings	$25,079,947	$21,569,679
Interest	7,019,614	6,749,809
Balance for dividends	$18,060,333	$14,819,870
Dividends paid	9,289,624	7,893,084
Undivided profits	$ 8,770,709	$ 6,926,786

The report of all the Associated Bell Telephone operating companies (not including the long-distance lines) of the American Telephone and Telegraph Company for the month of November and eleven months ended November 30, 1908, compares as follows:

November:	1908.	1907.
Telephone revenue	$10,323,600	$ 9,880,200
Oper. and maint. expenses.	7,309,100	7,046,000
Balance from operation.	$ 3,014,500	$ 2,834,200
Sundry earnings (net)	446,100	382,000
Total net	$ 3,460,600	$ 3,216,200
Interest	623,600	654,600
Balance for dividends	$ 2,837,000	$ 2,561,600

January 1 to November 30:	1908.	1907.
Telephone revenue	$109,492,200	$103,773,200
Oper. and maint. expenses.	79,824,500	76,459,400
Balance from operation.	$29,667,700	$27,313,800
Sundry earnings (net)	4,742,700	4,188,900
Total net	$34,410,400	$31,502,700
Interest	7,012,000	6,581,500
Balance for dividends.	$27,398,400	$24,921,200

The maintenance charges and taxes included in the above expenses for November and eleven months compare as follows:

November:	1908.	1907.
Maintenance	$ 2,764,300	$ 2,665,900
Taxes	440,700	331,800
Total	$ 3,205,000	$ 2,997,700

TOLEDO RAILWAYS AND LIGHT.

The report of the Toledo Railways and Light Company for the month of November and eleven months ended November 30 compares as follows:

	1908.	1907.
November gross	$ 219,761	$ 220,019
Expenses	117,372	116,957
November net	$ 102,389	$ 103,062
Other income	124	735
Total income	$ 102,513	$ 103,797
Charges and taxes	71,960	67,925
November surplus	$ 30,553	$ 35,872
Eleven months, gross	2,302,658	2,328,255
Expenses	1,257,178	1,331,495
Eleven months, net	$1,045,480	$ 996,960
Other income	3,384	10,075
Total income	$1,048,864	$1,006,835
Charges and taxes	779,657	726,391
Eleven months, surplus	$ 269,207	$ 280,444

NASHVILLE RAILWAY AND LIGHT.

The Nashville Railway and Light Company reports earnings for the month of November and eleven months ended November 30, 1908, compared as follows:

	1908.	1907.
November gross	$ 138,598	$ 139,559
Expenses and taxes	79,271	87,182
November net	$ 59,327	$ 52,377
Interest charges	32,507	31,232
Balance	$ 26,820	$ 21,145
Reserve funds	4,165	2,500
November surplus	$ 22,655	$ 18,645
Eleven months, gross	1,447,947	1,438,159
Expenses and taxes	865,551	859,201
Eleven months, net	$ 582,396	$ 578,958
Interest charges	352,127	325,309
Balance	$ 230,269	$ 253,649
Reserve funds	43,319	35,210
Eleven months, surplus	$ 186,950	$ 218,439

The Cement Industry in 1908.

A statement regarding conditions in the American Portland cement industry during the year 1908 has been prepared by Edwin C. Eckel for the United States Geological Survey.

Although detailed figures are not yet obtainable, an estimate based on the information available indicates that the production of Portland cement in the United States was somewhat less than 40,000,000 barrels. This compares as follows with the output of recent years:

1905 .....35,246,812 barrels
1906 .....46,463,424 barrels
1907 .....48,785,390 barrels
1908 (estimated) .....40,000,000 barrels

The heavy falling off from the 1907 output is particularly notable, because it is the first decrease shown in any year by the American cement industry since its inception. The decrease was not uniformly distributed throughout the country, for New York, Pennsylvania and New Jersey will probably show the highest percentages of loss, while in some portions of the West and the Middle West the decrease was relatively slight.

Electric Motor Trucks for Members of Congress.

The problem of transporting members of Congress from the new House and Senate office buildings to the Capitol, has become more pressing as the new Senate building nears completion. The generally greater age and physical infirmities of the members of the higher house of Congress seems to make some means of transportation imperative beyond the requirements imposed by the comparatively more active Representatives. A subway is provided between each office building and the Capitol and one of the first plans proposed was a miniature electric railway, but this was given up as it was feared that trucks running on rails would be too noisy. The moving-sidewalk scheme, which was at one time considered, has also been abandoned.

The superintendent of the Capitol, Elliott Woods, now proposes an adaptation of the electric trucks used for transporting baggage at some railroad stations. These trucks are autocars and are found convenient in the extreme. It is thought that small, rubber-tired trucks or cars, with electric power, provided by storage batteries, can be made use of in the subways between the Capitol and the office buildings. The vehicles can be so made as to be usable in case of need for carrying books and other freight. In those hours of the day when Senators and Representatives most need them, they can be provided with seats on which statesmen can be quickly and safely transported.

Judge Rules Against Public Service Commission in Interborough Rapid Transit Suit.

The right of the Interborough Rapid Transit Company to deliver power to the New York City Interborough Railway Company, without first obtaining permission from the Public Service Commission or the city authorities, has been upheld by the Court of Appeals. An action was begun by the city of New York and the Public Service Commission to prevent such sale by injunction. On April 10, 1908, the Appellate Division sustained the application of the Interborough Rapid Transit Company in the case in which the Public Service Commission sought to restrain the company from delivering electric current to a subsidiary company without first obtaining the consent of the Commission. The Court of Appeals decision is in affirmation of this.

ALTERNATING CURRENTS AND THEIR APPLICATIONS.

BY EDSON R. WOLCOTT.

CHAPTER III. (PART II)—MOTORS.

THE ROTATING MAGNETIC FIELD.

A method of illustrating the rotation of the magnetic field produced by polyphase currents is shown in Fig. 65.

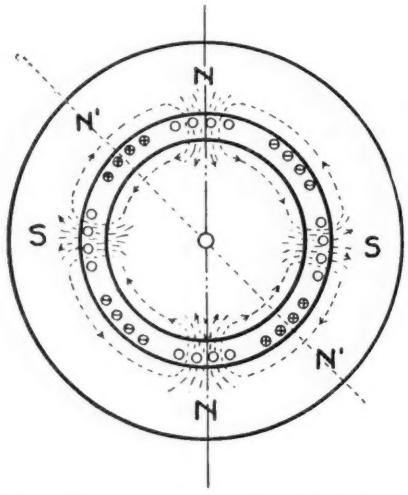


FIG. 65.—ARRANGEMENT OF WINDINGS FOR TWO-PHASE ROTATING FIELD.

Let the eight groups of small circles represent cross-sections of the stator windings of a two-phase induction motor. At a certain instant consider a current to flow up from the paper in those groups marked with the negative sign, and down in those marked with a positive sign. Magnetic lines of force will then be generated in the directions indicated by the arrows, forming north poles at the points N and south poles at the points S. The lines of force travel partly in the iron of the stator, and partly in that of the rotor,

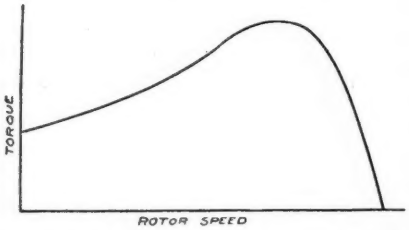


FIG. 66.—RELATION OF TORQUE AND SPEED OF AN INDUCTION MOTOR.

passing through the air-gaps at the points N and S. The conductors of the rotor cut these lines of force, generating a current within them. The circles containing neither positive nor negative signs represent the windings of the other phase of the two-phase system, the current of which differs ninety degrees in phase with that in the windings marked. One quarter of a period later, the north poles will be shifted through an angle of forty-five degrees, as represented by the dotted line N'S', and the signs within the small circles will be shifted one group counterclockwise. In another quarter period the poles will be again shifted through forty-five degrees, and so on.

In this manner the magnetic poles produced by the two-phase current rotate around the stator, making, in this case, one-half as many revolutions per second as there are cycles per second of the current. If the number of pairs of poles developed in the stator is two instead of four, as it would be if the stator contained but four coils, instead of eight as shown, the speed of field rotation would be equal to the current frequency. In any multipolar machine the frequency of the rotating field is thus equal to the quotient of the current frequency divided by the number of pairs of poles set up by the rotating magnetic field.

SPEED AND TORQUE.

The turning moment or torque of the rotor of an induction motor is small when

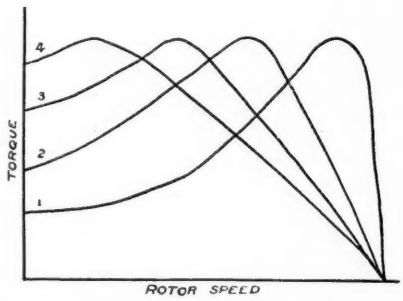


FIG. 67.—CURVES SHOWING EFFECT OF RESISTANCE INSERTED IN ROTOR WINDING OF INDUCTION MOTOR.

the motor is running on no load, its speed being but little less than that of the stator magnetism. If the rotor windings have a low resistance, there is little change in speed as the load is thrown on, but the speed will fall off greatly with load if the rotor conductors are not short-circuited and of large size. The electromotive force generated in them is small, and hence with much resistance the current will not be large enough to produce the necessary torque under load. The change of torque with speed is shown graphically in Fig. 66. The torque is zero when the speed of the rotor is synchronous with that of the rotating field. If the load be increased beyond the maximum torque, the latter drops off so rapidly that the motor will come to a standstill. This is called the "breaking down" of the motor.

When resistances are inserted in the rotor circuit by means of external connections to collecting rings, the starting torque is considerably increased, as shown by the curves in Fig. 67. Curve 1 shows the relation between torque and speed when no resistance is inserted, while curves 2, 3 and 4 show the effect of in-

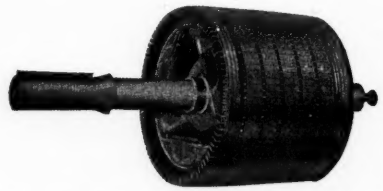


FIG. 68.—ROTOR CONTAINING INTERNAL STARTING RESISTANCE.

creasing the resistance in the rotor circuit. As shown, the starting torque increases as the resistance increases, and hence it is desirable to introduce sufficient resistance to produce the maximum starting torque if the motor is to start under load.

It is also, evidently, desirable to cut out this resistance after the motor is under way, so as to obtain higher efficiency as well as to lessen the tendency of the motor to change its speed as the load varies.

RATING.

An induction motor will run at a different frequency and voltage than that for which it is designed, though not so

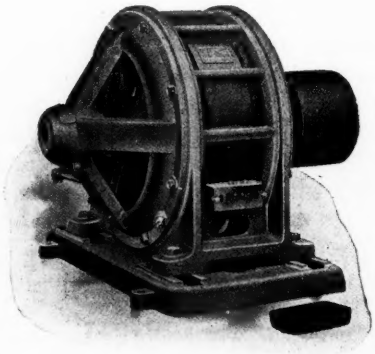


FIG. 69.—INDUCTION MOTOR WITH INTERNAL STARTING RESISTANCE.

efficiently. A change in the frequency produces a corresponding change in the speed, and a change in the voltage a much greater change in the torque.

All standard motors of this type will give about 100 per cent more torque than at the rated horsepower and voltage, thus

leaving ample margin for carrying a variable load.

The direction of rotation of an induction motor run from a three-phase circuit can be changed by reversing any two of the leads to the stator. On a four-wire two-phase circuit one phase should be reversed.

STARTING INDUCTION MOTORS.

Small motors may be connected directly to the circuit without the intervention of any special starting devices.

For large machines there are several methods of starting. In some cases the rotor windings are connected to three collecting rings, as already stated. A more general method is to insert this resistance within the rotor itself and adjust it by a knob on the end of the rotor shaft, or by a centrifugally operated switch, which short-circuits the internal resistance after the machine is under way. Fig. 68 illustrates such an armature or rotor containing internal resistanee which is gradually short-circuited as the motor starts. Fig. 69 represents the motor complete.

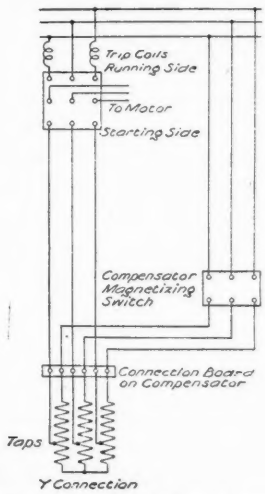


FIG. 70.—STARTING-COMPENSATOR CONNECTIONS FOR THREE-PHASE MOTOR.

STARTING COMPENSATORS.

Another method of starting is by the use of a starting compensator, which varies the voltage impressed across the terminals of the motor, so that only a low voltage is applied at first. The operation of the starting compensator depends upon the fact that the drop in potential over a coil carrying an alternating current is proportional to the product of the current flowing and the impedance. Thus, in the diagram of the connections of a compensator, shown in Fig. 70, by changing the connections at the taps in an upward direction, as shown in the figure, the terminal voltage of the motor may be decreased to a suitable value. On starting the motor the compensator switch is first closed, the motor switch being open. The latter is then closed on the starting side, and just before the machine reaches full speed the

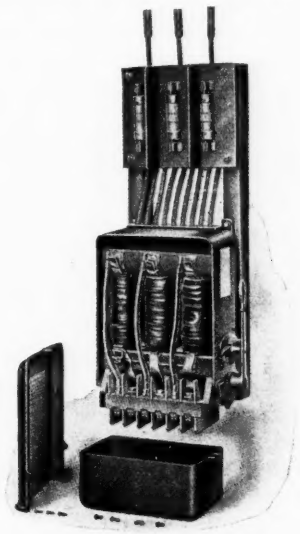


FIG. 71.—STARTING COMPENSATOR FOR THREE-PHASE INDUCTION MOTOR.

motor switch is thrown to the running side, after which the compensator switch is opened.

A similar device is shown compactly arranged in Fig. 71. The lever at the right has three positions: An "off" position, in which both compensator windings and motor windings are disconnected from the line; a "starting" position, in which the line is connected to the terminals and the motor to the taps of the compensator without breakers or fuses in

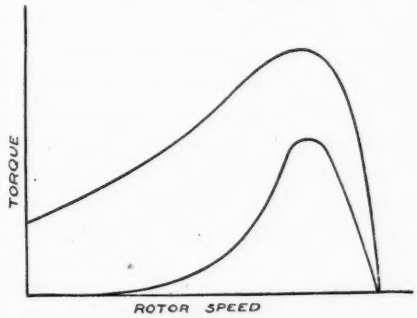


FIG. 72.—CURVES SHOWING EFFECT OF CUTTING OUT ONE PHASE OF TWO-PHASE INDUCTION MOTOR.

circuit; and a "running" position, in which the compensator is cut out and the motor is connected to the line through the fuses mounted above the compensator.

SINGLE-PHASE INDUCTION MOTOR.

It is possible to operate a polyphase induction motor on only one phase after it has been started. It is then a single-phase induction motor. The fact that it cannot start itself is clearly shown by the curves in Fig. 72. Curve 1 shows the relation between the speed and torque of a two-phase motor, and curve 2 shows the relation between the two when but one of the phases of the motor is connected. As is seen, no starting torque is developed in the latter case. The maximum torque developed is not as large and it occurs at a higher speed.

STARTING.—PHASE-SPLITTERS.

Motors of this type are sometimes started by means of what is called a "phase-splitter." This is an arrangement for deriving two currents differing in phase, from a single-phase current. The two windings of a two-phase motor are connected in parallel to a single-phase circuit, one directly and the other through a condenser or an inductance coil, either of which will cause a phase displacement and so produce a current out of phase with the original. The difference in phase between the two usually is not so great as ninety degrees, which is the theoretical angle between the currents of a two-phase system. It is, however, sufficient to produce the torque necessary for starting such small machines as fan motors.

STARTING AS REPULSION MOTORS.

Perhaps the best method of starting single-phase induction motors is to so wind them that they start as repulsion motors and can be converted into single-phase induction motors after attaining full speed.

Electricity for Farmers.

Dr. J. P. Jackson, in an address before the husbandmen attending Farmers' Week at the Pennsylvania State College, showed the aid of electricity in relieving the drudgery formerly associated with the farm. Dr. Jackson explained how loneliness could be obviated by the use of telephones, and how the new tungsten burner makes electric lighting of houses and barns possible at a rate little above the cost of kerosene. He pointed out the use of electric machinery for plowing, cultivating, feed-chopping, thrashing, wood-cutting and milking. Methods of lightening the housework, such as by electric churns, refrigerators, sewing machines, irons, ice-cream freezers and meat choppers, were discussed to the gratification of the women auditors.

THE ECONOMICAL DEVELOPMENT OF TOLL TERRITORY.—II.

BY FRANK F. FOWLE.

LEASED WIRE AND PRIVATE-LINE RATE SYSTEMS.

The leasing of private lines for telephone or telegraph service, or both, forms an important source of revenue to toll companies. Leased wires are used extensively by stock and grain brokers, packing companies, press associations and large industrial concerns. There is a good demand for such facilities at all times and there is some demand for private telephone circuits. The use of systems for simultaneous telephony and telegraphy makes possible a high degree of economy where the same line wires that are in use for commercial message traffic are also in use as leased telegraph circuits, earning revenue from two sources simultaneously. It is not usually possible to make such double use of all wires on one route, but fully fifty per cent of them can be so used.

The standard prevailing rate for leased telegraph circuits is $20 per wire-mile per annum, plus a charge for each intermediate station that may be connected to the circuit.

The prevailing rate for leased telephone circuits is $40 per circuit-mile per annum, plus a charge for each intermediate drop. In each case the leased wire subscriber furnishes his own operators; the telephone or telegraph company has on duty wire chiefs who look after all circuit trouble as it appears and, in the case of telegraph leases, telegraph operators are on duty at repeater stations to keep the repeaters in adjustment; wire chiefs are usually charged with the duty of supervising all leases. The $20 rate per wire-mile per annum is slightly in excess of the average gross revenue per wire-mile per annum which large toll companies are able to earn, which ranges between $15 and $20. The hours of service usually comprise a total of 10 hours, from 7 a. m. or 8 a. m. to 5 p. m. or 6 p. m. Rates for shorter hours are usually graded according to the general public demand for telephone service, in recognition of the principle that the relation between supply and demand fixes the price; the supply is constant and the rate is, therefore, graded in accordance with the changes in demand through the hours of the day. There is, however, very little demand for leased telephone circuits for short periods of one, two or three hours at any time of day.

A very attractive form of service which toll companies are in a position to offer exclusively is a schedule under which a leased wire subscriber may use the telegraph or the telephone as he chooses, except that he may not use both at the same time. That is, for a certain contract price, the subscriber is permitted a certain number of hours of telegraph service, or a certain number of hours of telephone service, or the alternate use of both in any manner such that the sum of the pro rata charges for each kind of service, regardless of how the subscriber alternates, does not exceed the contract price; excess service should be billed at the full message rates. An essential feature in any such rate schedule is the avoidance of discrimination, so that however the leased wire subscriber may choose to avail himself of service under his contract, the lowest equivalent price for telephone or telegraph service is consistent with the other rate schedules for public telephone message service and for exclusive telephone or exclusive telegraph leased-wire service.

In working out such a rate schedule it will be found practically necessary to confine the subscriber to telegraph service during the hours of maximum public demand for telephone connections, or otherwise, he may desire to change from telegraph to telephone service during the peak traffic load and thus congest the traffic unless spare facilities are waiting for him; spare facilities during the peak load cannot be provided on a profitable basis except at the rate for a ten-hour telephone lease. The possible rate combinations under the plan just described are too numerous to be described here at length, and it has been attempted to touch only upon the principal features of such schedules and to indicate how they may be constructed to secure additional business without providing additional line facilities.

Theoretically the rate for a leased circuit is arrived at as follows: Let $R =$ the total annual rate for a lease between any hours and over any distance. $M =$ the annual rate per mile between the contract hours, $l =$ the length of haul. $P =$ the terminal plant charges per annum, comprised of interest, depreciation, maintenance, taxes and insurance upon the leased-wire equipment and the loops to the subscriber's office and any rentals for the same when leased from another company, $n =$ the number of terminal and intermediate subscriber's offices. $L =$ the labor expense per annum for the daily setting up, adjustment, taking down and supervision of a lease at terminals, intermediate stations and repeater stations. $n' =$ the number of terminal intermediate and repeater stations where attendance is required.

Then the rate per annum is

$$R = l\,M + n\,P + n'L. \qquad (5)$$

The value of M can be tabulated for all possible intervals between any two hours of the day; M is determined by the annual interest, depreciation, maintenance and taxes upon the lines owned and the rentals for lines leased from other companies.

One further point may be brought out in reference again to the furnishing of operators for handling messages over leased circuits; the operators should be furnished by the subscriber in every instance, although it would be proper for the telephone company to furnish the operators and bill the subscriber for their wages at cost. The telephone company cannot handle the leased-wire subscriber's calls over the leased line at no further cost to the subscriber without discriminating against the patrons who pay the regular message rate. On the basis of $0.002 per minute-mile for message business, a use of ten hours per day for 300 days per year amounts to a charge of $360 per mile per annum, compared with $40 for a leased telephone circuit; the price on the latter amounts to a discount of 88.9 per cent from the message rate, in case the telephone company handles the connections or messages over the leased circuit, and most emphatically constitutes discrimination. When the leased-wire subscriber handles his own messages the two classes of service are dissimilar and the subscriber is burdened with his own operating expense. In all respects the subscriber's operators will be best situated upon his own premises under his control.

Many of the fundamental factors in rate-making are independent of any considerations of the telephone business, but in some respects the preceding consideration of rate-making has necessarily anticipated what is to follow. The consideration of rate systems and principles naturally comes first in the order of topics, because all that follows is based upon it. The next topic is that of traffic and the methods of determining in advance how much traffic may be expected between any two toll points or zone centers.

1. From a paper read before the International Independent Telephone Association, Chicago, Ill., December 1, 1908.

THE PREDETERMINATION OF TRAFFIC.

The traffic in transportation of passengers or intelligence depends primarily upon the density of population and secondarily upon the rates. It is a proven fact that the traffic becomes greater as the density of population increases and as rates diminish, and vice versa. It is important to arrange these facts in the form of a law which may be given mathematical expression, if possible, so that there may be little risk in developing new territory and extending the service.

The specific problem in hand is this: Given the population and the number of telephones in each of two zones, the distance between the zone centers and the rates to be charged for toll service, what will be the volume of traffic? It should be understood at the outset that whatever formula may be developed must be based upon a study of actual traffic in an existing plant and that it will necessarily represent an average so far as individual local conditions are concerned. The actual traffic which is realized after a plant is built may differ considerably in individual instances from the predetermined traffic, but this should not be true of the total traffic in a territory of considerable size. No formula can be developed that will take into account all local conditions, but the average of local conditions in any territory of reasonable size will be taken into account in any formula which is deduced from traffic conditions and results in a similar territory which has been developed; an engineer cannot forecast the results in any new territory more accurately except in so far as his intimate knowledge of local conditions and experience in such matters form a special guide.

A study has been made of the traffic between different cities and towns, taking into account their population and the distances between them under a fixed rate schedule. It has not been possible to make an extended study of different systems in which the rate schedules were all different from each other; but notwithstanding, it has been possible to secure a few observations upon the effect of rate changes. After considerable study it was found that the traffic volume in total messages per month in both directions between any pair of zones could be fairly represented by the formula:

$$T = K \frac{P_1 P_2}{D^2} \qquad (6)$$

where T = the total messages per month, in both directions.

P_1 = population of either zone.

P_2 = population of the other zone.

D = distance between the zone centers, in miles.

K = a constant.

The determination of K was made from the average of eight months' traffic between thirty-four pairs of zones. The average of these thirty-four values of K is 2.21×10^{-4} and the mean deviation of the individual values from this average value is $\pm\ 0.43 \times 10^{-4}$. The formula may therefore be written, when 2.2×10^{-4} is substituted for K, as follows:

$$T = .00022 \frac{P_1 P_2}{D^2} \qquad (7)$$

and may be regarded as possessing sufficient accuracy for a development study. The range of distances and population in the instances upon which the calculations for K were based was very large; no account was taken of the telephone development in the zones used for calculation, but it varied from something like one per cent up to eleven or twelve per cent, with an average of six to seven per cent. It should be noted that the average deviation of the individual values of K from its average value is 19.5 per cent, which may be understood as meaning that when the formula is applied to individual cases the calculated result will, on the average, be about twenty per cent higher or lower than the traffic which will actually be realized; the total traffic in a large territory, obtained by the application of the formula between all toll zones within it, will be on the average within three-and-one-half per cent of the traffic actually realized.

It is very important to note that special conditions will give results that may be much larger or smaller than those which the formula indicates; in deriving the formula all special conditions were avoided, so far as known. It is assumed first, that the territory is continuous mainland as distinguished from islands and peninsulas, and that there are no great natural barriers of any sort. The traffic to summer resorts may be three or four times as great as that given by the formula because of the large temporary population; the traffic to state capitols during sessions of the legislature may be several times larger than that given by the formula; there may be special conditions at seaports or lake ports which create additional traffic; a small town which is dominated by one or two large industries may create a special traffic condition; the traffic to and from a particular zone may be restricted because of poor transmission and badly delayed service, and so on—the various toll zones must be carefully scrutinized to discover all local conditions which in any sense are special or unusual.

At this point the author wishes to say that formulæ (6) and (7) are here given for the first time, and it is believed that this is the first time that any relation has been stated between the volume of toll traffic, the distance between the zones connected and their respective populations. Further investigation should result in some refinement of the formula and the value of K to use under special conditions and with other rate schedules; the rates here in force were approximately $.002 per minute-mile day rate and a night half-rate, based on railroad mileages. The mileages used in the computation of K were the pole-line mileages, which bear an average ratio to the air-line mileages of 1.34. In terms of air-line mileage the formula becomes

$$T = .000123 \frac{P_1 P_2}{D^2} \qquad (8)$$

A highly precise determination of the traffic volume would be of no greater value than one whose precision is not better than $\pm$ five per cent, for the reason that there are daily, weekly and monthly variations in the traffic which exceed this amount. The traffic varies from day to day, Monday usually being the heaviest of the five days from Monday to Friday, inclusive; the load curves of calls received per hour or half-hour during each day of these days are similar.

Fig. 1 shows a typical curve of daily total traffic in an office of moderate size; attention is called to the fact that, while the total traffic on a Saturday is below the other week days, the hourly or half-hourly load reaches the weekly maximum. The traffic in one direction between two zones is usually greater or less than the traffic in the opposite direction, being more often unequal than equal; this point is one which it is well to keep in mind when considering double-track operating systems. If the traffic increased steadily month by month through the year, the traffic during any month would exceed that of the previous month by one-twelfth of the total annual growth; a comparison of actual monthly traffic with the traffic as it would have been under the assumption of steady growth will show the characteristic monthly variations. Such a comparison has been made, and the results are tabulated below, being the averages computed from the monthly traffic in and out of a given office for five years. The

results are expressed in per cent, a plus sign indicating a result higher than normal and a minus sign indicating a result lower than normal.

Month.	Deviation of Traffic From Normal.
January	+1.23%
February	—6.45%
March	+6.79%
April	+3.11%
May	+2.39%
June	—0.87%
July	—4.57%
August	—2.92%
September	—4.38%
October	+3.99%
November	—0.43%
December	+4.29%

February is a twenty-eight-day month with one holiday, which accounts for the depression; November is a thirty-day month, also, with one holiday. Aside from these deviations, the figures show a general depression of business during the summer months and an excess during the winter months. It is obvious that comparisons of the traffic in any given month with the traffic in the month preceding are misleading, unless interpreted with due allowance for these variations.

After the formula has been used to compute the probable amount of traffic between all the toll centers in a given territory, the following plan may be employed for checking the results: Compute the total probable revenue, from the traffic figures and the rates, on the basis of an average length of conversation of four-and-one-half minutes, on the traffic between each pair of zones or toll centers; next compute the total revenue on the traffic in and out of each toll center and take half of that amount as the revenue on the originating traffic; from the latter amount compute the annual toll revenue per head of population within the zone or district. An average value for the total annual toll receipts per head of population is $0.50, but this figure varies, however, between the approximate limits of $0.25 and $1.00; in territory having poor development as regards exchange telephones, a value between the lower limit and the average will be the safest one to use, and of the toll companies now operating probably more than sixty per cent receive less than $0.50 per head per annum. These figures are derived from territories where the average rate is probably a little below $.002 per minute-mile, but not substantially different; where there is no reduced rate at night the total annual receipts per head of population are probably ten to fifteen per cent higher than the figures above given.

At the same time that the total receipts are computed for each toll office, the total traffic may be computed also. The traffic figures, when arranged according to the length of haul, will show very forcibly how the volume of traffic decreases with increasing hauls; the length of haul is one of the considerations which affect the choice of the best operating method to handle toll traffic. Fig. 2 was prepared from the outward traffic of a toll office, arranged in the order of hauls, on air-line mileage; the curve shows what proportion of the total outward messages is longer than any particular haul, all business of less than forty miles haul being excluded. This type of curve will be of use in laying out a toll-circuit scheme to handle the

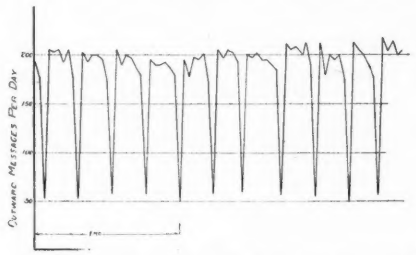


FIG. 1.—TYPICAL WEEKLY LOAD CURVES.

traffic, as regards a proper division of the total circuit mileage between long-haul, intermediate-haul and short-haul circuits. This type of curve will necessarily vary for different offices, according to the distribution of cities and towns around it; but for a territory as a whole, which is evenly populated with towns and cities and is continuously settled and developed, the curve will not differ materially from similarly prepared curves for like territories.

There are several useful ratios expressing the relation between the total traffic for a month, and the traffic on particular

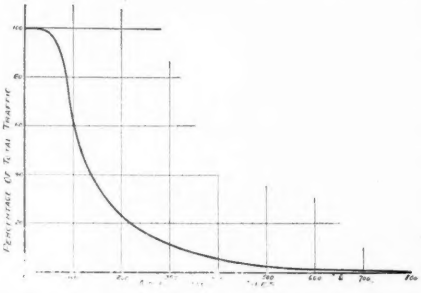


FIG. 2.—LENGTH OF TRAFFIC HAUL.

days of the week; it is necessary to obtain such ratios for use in traffic calculations. The following ratios have been computed from the daily total outward traffic from a toll office, for a period of eight months, and are therefore reliable averages:

Average ratio of daily traffic to monthly traffic, for Monday to Friday, inclusive..	.0370
Average ratio of daily traffic to monthly traffic, for Saturday only.....	.0340
Average ratio of daily traffic to monthly traffic, for Sunday only.....	.0101
Average ratio of maximum day's traffic to monthly traffic	.0410

It may seem to many a curious result that a formula for predetermining the traffic could be developed without taking into account the ratio of telephones to population, or percentage of development. It is well known that toll traffic increases as the development increases, and it would be reasonable to expect that the percentage of development would have necessarily to be a factor in any formula such as has been presented above. On the other hand, toll traffic increases with the growth of population, which fact is contained in the formula; that is, a ten per cent increase in the population of each of two zones will be attended by a twenty-one per cent increase in toll traffic between them, other things remaining constant. There is undoubtedly a variation in the value of the constant K, as it would be deduced separately from the traffic in each of several large territories containing each the same total population, but differing materially in percentage development. Fifteen years ago the annual toll receipts per head of population were slightly below $0.25, and at that time the development of the United States as a whole was only a fraction of its present development; the corresponding value of K would probably be forty per cent of the value deduced above. It will be advisable, therefore, to check the value of K every few years, as the development increases, and it will be reasonable to expect K to increase.

The effect upon the traffic of the amount of the unit rate—the minute-mile rate—is a subject upon which there is only meager data, aside from the general principle that, as rates diminish traffic increases, and vice versa. The elimination of night half-rates furnished an opportunity for observation of the effect of a rate change upon traffic; in general, it may be said that the result is a reduction of the night traffic, not constant in amount as regards different sections of territory, and not exceeding fifty per cent of the night traffic as a whole. This particular instance may be summed up in the statement that doubling the rate reduces the traffic by an amount slightly less than half—the net change in revenue being a small increase. If the converse of this proposition is true, it follows that halving the rate will not quite double the traffic; or, expressing the principle in more general form, a given percentage change in rates will produce an opposite change in traffic, whose percentage is slightly less.

[To be continued.]

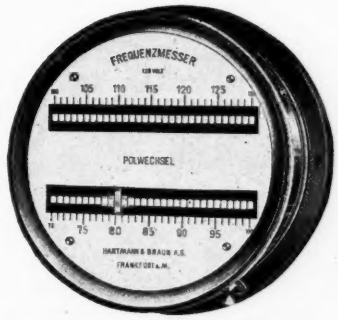
QUESTIONS AND ANSWERS.

THE FIRST TELEPHONE EXCHANGES.—Please tell me as nearly as possible where and when the first of the various kinds of telephone exchange listed below was installed: 1. First telephone exchange of any kind. 2. First Law exchange. 3. First magneto exchange. 4. First multiple office (not common-battery type). 5. First common-battery multiple exchange. —E. W. C., San Francisco, Cal.

After the invention of the telephone its application to commercial and social service was quite rapid, a large number of installations being made in various parts of the country. Therefore historical records of the first use of improvements in the telephonic art are somewhat conflicting. The following answers to the questions above are based on information supplied through the courtesy of Messrs. T. B. Doolittle and Thomas D. Lockwood of Boston, Mass.: 1. The priority for the first telephone exchange seems to be with an installation opened on May 17, 1877, at 342 Washington Street, Boston, by E. T. Holmes, who developed it as an adjunct of a burglar-alarm system he had already established. However, it is asserted by some authorities and denied by others that the messages between different subscribers of the exchange were verbally transmitted by the operator. Another installation that has claim to priority was that of the Bridgeport Social Telegraph Company in Bridgeport, Conn., which had about sixteen subscribers connected with a switchboard in the office of the Atlantic and Pacific Telegraph Company, between which connections were made by an operator almost exactly similar to the telephone connections, except that the calls were by telegraph. Upon the advent of the telephone the annunciator drop was connected with the switchboard which was of the so-called "Western Union" type. During the fall and winter of 1877 a large percentage of the subscribers were connected by telephone. The first telephone exchange established on commercial telephone lines exclusively was opened on January 28, 1878, in New Haven, Conn. 2. The first "Law" exchange was opened in New York city in the spring of 1875 by the Law Telegraph Company. It was a telegraph exchange using dial telegraph instruments and call bells. Some time later the telegraph instruments were replaced by telephones. 3. It is difficult to fix the date and location of the first magneto exchange, as the magneto bells were distributed and went into general use simultaneously on private lines and exchanges. 4. The first multiple system was invented and installed by L. B. Firman in the Western Union Exchange, Chicago, Ill., in 1879. 5. The first common-battery multiple exchange was installed in Lexington, Mass., by Dr. Hammond V. Hayes on December 15, 1893.

FREQUENCY METER.—Lately I saw an instrument for showing the frequency of an alternating current that had a set of small squares vibrating inside a scale. I believe it was built by a German firm. How does it work?—W. H. T., St. Louis, Mo.

The instrument referred to is doubtless the frequency meter made by Hartmann & Braun, Frankfort-on-Main, Germany. It is made in either the switchboard or portable types. As shown in the accompanying illustration, the scale is usually divided into two horizontal lines, opposite each of which is a set of reeds that are capable of vibrating vertically. Its action is based on the fact that a flexible rod



HARTMANN & BRAUN FREQUENCY METER.

fastened at one end and free at the other has a natural vibration period dependent on its length and mass and will be set in vibration only when the frequency of the applied impulses coincides with its particular period. A row of steel strips, each attuned to a frequency differing by, say, one vibration per second from its neighbor, is set up and subjected to periodically recurring blows by means of the energizing and de-energizing of an electromagnet through whose coils the alternating current passes. The number of blows per second (twice the frequency) is at once indicated by its putting the correspondingly attuned strip into violent vibration. When the frequency is intermediate that of two adjacent reeds, both are set into partial vibration, thus a reed having a period of ninety vibrations and whose free end will vibrate through an arc of one inch under this stimulus will diminish its amplitude to only one-third of this when subjected to 90.5 impulses per second, to one-fourth at ninety-one, and will not vibrate perceptibly at ninety-three. By this means the frequency is determined accurately at a glance.

STORAGE-BATTERY END PLATES.—Why are the end plates of a storage battery always negative plates? Would it not be just as well to have the same number of positive as negative plates in each cell?—A. F. B., Lexington, Ky.

Aside from what are known as couples, *i. e.*, cells having only one positive and one negative plate, all cells of the common lead type of storage-battery have one more negative than they have positive plates. This is so that the outer plates of each cell are negatives. One reason for this is that the latter plates can bear handling more readily than positives, so that when the whole element is removed from the cell the positives are protected. A more important reason is that the active material in both sets of plates, but in the positives particularly, undergoes volume changes during charge and discharge. On the positives the expansions and contractions are so marked that if such a plate were charged and discharged continually from one side only, as it would if it were an end plate, the plate would soon buckle and disintegrate. When the positives are put in the interior of the cell, both sides of each plate are acted on quite uniformly and little distortion results normally. The outer negatives are frequently made thinner or formed on but the inner side. In couples this action is not so marked, since they are usually charged and discharged at very low rates. However, couples buckle more readily than any other form of storage cell.

RELATIVE PROPORTIONS OF COPPER AND IRON IN GENERATORS OR MOTORS.—How is it possible to determine the correct proportion of copper to iron in designing a direct-current dynamo or motor? In an alternating-current generator or motor? Does the electromotive force make any difference in regard to the proportion of copper to iron?—E. J. W., St. Paul, Minn.

A number of factors influence this ratio so that it is not possible to lay down any fixed values. Among these factors are: Permissible cost of the machine, ratio of electromotive force to output, efficiency and regulation desired, nature of the service, etc. For instance, a high-voltage for a particular output requires a larger proportion of iron than a low voltage and large current for the same output. For direct-current machines the ratio of copper to iron may vary from one to one-and-one-quarter up to one to eight, depending on the relative balancing of the factors referred to. For alternat-

ing-current machines this ratio may run from one to three up to one to eight or over. The question asked is too general to give more specific ratios. The inquirer may get the information he desires from any good book on dynamo design. A recent contribution on the subject is a paper on "The Relative Proportions of Copper and Iron in Alternators," read by Carl J. Fechcheimer before the annual convention of the American Institute of Electrical Engineers at Atlantic City on July 2, 1908.

COMMUTATING-POLE MOTORS.—What is meant by a commutating-pole motor and what advantage does this construction possess?—F. J. M., Auburn, N. Y.

A commutating-pole motor is a direct-current motor having auxiliary magnet poles intermediate its main field poles. These commutating poles or "interpoles" are excited by the armature current, *i. e.*, they are connected in series with the armature. Their chief function is to provide a field that will compensate that due to the armature current and thus to provide a satisfactory means of commutating that current. The advantages of this construction are: Sparkless commutation even on heavy overloads; less wear on the commutator and less copper and carbon dust from the commutator and brushes; reduced heating of the commutator; greater current density and longer life of brushes; great speed variation possible by adjustment of field resistance; increased efficiency because of lower core and commutator losses.

EFFECT OF DIELECTRIC THICKNESS ON CONDENSER CAPACITY.—In a statement of the principle of the condenser on page 956 of the issue of December 19 the capacity of a condenser was given to vary inversely as the square of the thickness of the dielectric between the plates. This is an error. The capacity varies not as the square but as the first power of the dielectric thickness.

Superintendent of Construction.

The United States Civil Service Commission announces an examination on February 3 at the usual places to secure eligibles to fill six or more vacancies in the position of superintendent of construction of public buildings at salaries ranging from $1,600 to $2,500 per annum. Applicants should apply at once to the United States Civil Service Commission, Washington, D. C., for application form 1312.

Hazards of the Electrical Occupations.

According to the compilation of "Industrial Accidents" by Frederick L. Hoffman in the *Bulletin of the Bureau of Labor*, the United States census reports covering the years 1900 to 1906 show that out of over 1,000,000 deaths of males, more than nine per cent were due to accident. A large proportion of these deaths are due to causes more or less related to the occupations of the injured persons.

According to the industrial-insurance experience, the fatal-accident rate of electricians and of electric linemen is excessive. Of 645 deaths of electricians, 14.7 per cent and of 240 deaths of linemen 46.7 per cent were due to accidents.

Central electric-light and power stations alone in 1902 gave employment to 6,996 salaried officials and clerks and 23,330 wage-earners, all more or less exposed to the risk of accidental death and injury. The accident statistics for the state of New York for the five years ending with 1905 return 1,923 recorded casualties, of which only sixteen, or 0.8 per cent, were fatal. Of the total number of accidents 82.3 per cent caused temporary disablement and 16.8 per cent permanent disablement.

In the manufacture of electrical machinery, etc., more than 60,000 wage-earners are employed, and in addition more than 10,000 salaried officials, clerks, etc., who, however, are much less seriously exposed to the danger of electrical accident than men in responsible positions in central light and power plants. The statistics also have no reference to the accident liability of electric railway employes.

A prominent American insurance company, at the Jamestown Exposition, exhibited the results of its industrial mortality experience for the period of 1897 to 1906 for certain well-defined groups of persons employed in the electrical industry. According to this experience, out of 645 deaths of electricians, ninety-five, or 14.7 per cent, were from accidents, but the proportionate mortality was highest at ages 25 to 34, when 19.1 per cent of the deaths from all causes were from accidents, decreasing to 15.4 per cent at ages 25 to 34, to eleven per cent at ages 35 to 44, and to 7.8 per cent at ages 45 to 54. Among electric linemen there occurred 240 deaths during the period mentioned, of which 112, or 46.7 per cent, were from accidents. At ages 15 to 24 the proportionate mortality from accidents was 55.3 per cent of the mortality from all causes, increasing to 56.8 per cent at ages 25 to 34, and decreasing to 38.2 per cent at ages 35 to 44, and to thirty per cent at ages 45 to 54.

Resolutions on the Death of Frederick A. C. Perrine, Member A. I. E. E.

At a meeting of the Board of Directors of the American Institute of Electrical Engineers, held on December 11, 1908, the following resolutions on the death of Dr. Frederick A. C. Perrine were adopted:

Whereas, Frederick Auten Combs Perrine, as a graduate student at Princeton University, as electrician of the United States Electric Light Company, as manager for John A. Roebling's Sons Company, as treasurer of the Germania Electric Company, as chief engineer of the Standard Electric Company, as president of the Stanley Electric Manufacturing Company, and as professor of electrical engineering in Leland Stanford, Jr., University, was of great influence in raising the standard and in extending the scope of the electrical engineering profession; and

Whereas, He, as a director and as a committeeman of the American Institute of Electrical Engineers, heartily participated in its activities, thereby extending its usefulness; it is hereby

Resolved, That the Board of Directors of this Institute considers that his death, on October 20, 1908, has deprived the Institute of a much valued member and the electrical engineering profession of an active and resourceful worker; and, it is further

Resolved, That these resolutions be spread upon the minutes of this meeting, that they be printed in the Proceedings, and that a copy of them be sent to Mrs. Perrine.

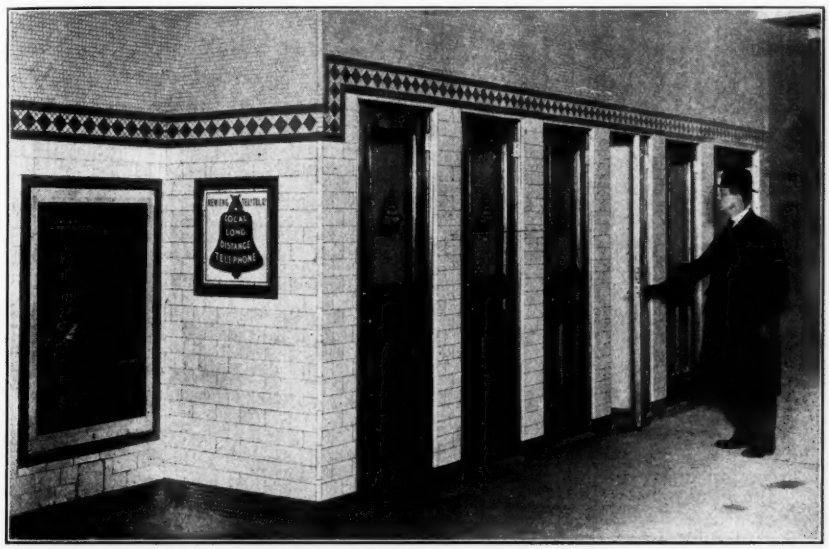
Ten Per Cent of General Electric's Copper Needs Supplied from Its Own Mine.

During 1908 the General Electric Company secured from its Bully Hill mine a total of about 3,500,000 pounds of copper, which was about ten per cent of the total copper requirements of the company for the year. It did not begin to get returns from the Bully Hill property until April and monthly production since that date has averaged about 400,000 pounds, which is just about about forty per cent of the maximum production toward which the management is bending its efforts. Ultimately the company hopes to get twenty per cent of its normal copper requirements from this mine.

TELEPHONE SERVICE IN THE WASHINGTON STREET TUNNEL, BOSTON, MASS.

BY H. S. KNOWLTON.

The new tunnel under Washington Street, Boston, which was opened for traffic on November 30, 1908, contains what is probably the most complete telephone installation in any subway in the world. The tunnel was built by the Boston Transit Commission and is leased by the Boston Elevated Railway Company. The telephone installation was designed specially for the tunnel requirements, and provision was made in the tunnel itself by the architects for the demands of the telephone, both for public and private use. The accompanying illustration shows the general scheme adopted in the tunnel stations, where the public pay station and company booths are housed in special tile-covered compartments whose appearance is consistent with the general scheme of station decoration employed.



TELEPHONES IN THE ESSEX STREET STATION OF THE WASHINGTON STREET SUBWAY, BOSTON, MASS.

The installation was worked out according to the designs of the New England Telephone and Telegraph Company, which provides all the service for both the public lines and the private wires of the Boston Elevated Railway Company. There are eight stations in the tunnel, and in these are located a total of twenty-four pay stations for public service and eight private instruments for railway service. In general, the more important stations are equipped with four public telephones each, as at Boylston, Essex, Winter and Summer Streets. At the Milk, State, Friend and Union tunnel stations there are two instruments per platform. The general arrangement is a row of six compartments, as shown in the photograph, four compartments being used by the public, and one by the railway company. The sixth compartment is used as a transfer booth by the railway company in connection with the interchange of passenger traffic with the surface car lines which it operates on the streets above. Each compartment is thirty-six inches long by thirty-three inches wide. The compartment walls are of concrete about six inches thick, and the floors are of wood, hard variety, one inch thick. The rear wall of the booth is formed by the glazed tile surface of the station wall proper. The outside walls are finished with a mosaic agreeing with the general design of the station interiors. Each booth is provided with metal doors equipped with double glass fronts. The entire tunnel is of fireproof construction. Each booth is illuminated by a sixteen-candlepower incandescent lamp, current being furnished free of charge by the Boston Elevated Railway Company.

In each booth is a standard Gray No. 7 pay-station set of the three-slot type, mounted about five feet above the booth floor, with an adjustable transmitter arm. The instruments are mounted on the walls, and the only other fixture in each booth is a special bronze bracket about three inches long, from which the directory is hung. In normal conditions the book hangs away from the wall, so that there is no chance for the chain to scratch or abrade the wall itself, as has sometimes been the case in earlier installations. It has not been found necessary to install electric heaters in the telephone booths. The New England company's No. 20 signs, set in frames of tiling, appear on each end of the booth structures, and on the outsides of the glass doors are mounted No. 5 signs, all forming conspicuous advertisements in the interests of the telephone service. At the four principal tunnel stations the booths are located about midway between the main entrances and exits of the platforms.

The cable service supplying these pay stations is connected with the Fort Hill exchange of the telephone company, where the lines are distributed among six positions. The tunnel cable is run from a manhole at Devonshire and Water Streets through a three-inch iron pipe conduit beneath the floor of the Milk station passageway to a main longitudinal tunnel cable running north and south through the tunnel itself. The main cable is a thirty-pair line of No. 19 wire, and at each station five-pair taps are taken off laterally for the local pay-station service. One of the pairs is an extra. The cable dwindles in size until at the south end of the tunnel only five pairs are left. North of Milk station the cable is run as a ten-pair line. The cable runs between stations in the tunnel in lead-covered form, carried on the walls about on a line with the top of the train windows, and mechanically supported by a suspension wire and eye-bolts, as in the Locke aerial construction. At the stations the cable is carried along beneath the edge of the platforms, and where it is necessary to cross from one side of the tunnel to the other to meet the staggered platforms the cable runs in a one-and-one-half-inch iron pipe. At each platform the five pay-station pairs are run under the concrete surface to a vertical riser terminating in a five-pair terminal box from which individual pairs are run to the different telephones in the booths. Fuses are provided in each terminal box.

All the pay stations are without attendants. The first month's experience, including thirty-two days, showed a total of 6,232 metropolitan and suburban calls, giving an average of 195 calls per day for the twenty-four stations. Each station averages eight calls per day. The best day per telephone station showed twenty-eight calls on one instrument. It is anticipated that the traffic will increase as the public becomes more familiar with

the use of the tunnel and better acquainted with the telephone facilities offered.

On the balance of the Boston Elevated system there are about fifty-seven pay stations. The East Boston tunnel has four fireproof Brownell booths; the elevated division has sixteen Brownell booths; the Tremont Street subway has sixteen Brownell booths, and the various waiting rooms and transfer stations on the company's surface lines have twenty-one pay stations, of which fifteen are booths. All these are Gray No. 7 slot machines. The booths in the Tremont Street subway are cared for twice a month by the Buildings Care Company, of Boston. All the subway telephone service is handled from the Oxford exchange, while the East Boston tunnel service is operated from Fort Hill. The elevated and surface line telephones are operated from various exchanges in their vicinity. The private telephone service of the Boston Elevated is furnished by the New England company, and the cables in the subways and tunnel lines are run in the railway company's own conduits at the side of the tracks. The operating centre for this service is at the railway company's main offices on Milk Street, and all parts of the system, covering 475 miles of track, are connected with this central private branch exchange.

$25,000,000 Needed to Rehabilitate New York City's Electric Car Lines.

Within two or three years $25,000,000 should be expended on the street-railway lines of New York city, says Oren Root, vice-president and general manager of the New York City Railway Company. This declaration means that another $15,000,000 should be appropriated for rehabilitation after the expenditure of about $10,000,000 for contracts already let. The receivers have borrowed on certificates $3,500,000, and have spent or contracted to spend $4,000,000 more.

American Telephone Stock Increased to $300,000,000.

The stockholders of the American Telephone and Telegraph Company have authorized an increase in the capital stock from $250,000,000 to $300,000,000. This increase is to provide a sufficient margin for the conversion into stock, on March 1, of the $150,000,000 four per cent convertible bonds which will then be outstanding. The amount of stock at present unissued is $69,413,000, the amount of stock now issued being $180,587,000.

Some Impressions of the United States Patent Office.[1]

For a temporary employment extending from a few months to several years, the United States Patent Office offers opportunities which are ideal. Since the profession of engineering is fundamentally the profession of invention, and the engineer's ideas are his capital, or stock in trade, a knowledge of the means of protecting these ideas is of considerable importance. And this knowledge a term in the United States Patent Office gives.

My experience at the Patent Office began one June morning with the taking of the oath of office. This process consisted in presenting my credentials, filling out several blanks certifying that I was verily and truly the same person who had taken the examination, and winding up with a solemn declaration that I would defend and uphold the Constitution of the United States, and would faithfully serve the government.

This formality completed, the process of introduction was begun and I was made acquainted with the commissioner of patents, assistant commissioner, etc., including the major dignitaries of the office. Throughout the officials were extremely kind and sociable, this being a distinctive characteristic of the office, which gives the impression of an enormous school rather than one of the most overworked of the governmental departments. This fact, together with the interesting nature of the work and the fact that almost without exception the examiners are college or university men, makes the position of patent examiner one of the most desirable under the government.

Among those to whom I was introduced was an amiable old gentleman with white hair and beard, and the manners of a country deacon. He proved to be the primary examiner of the division to which I had been assigned, and had the reputation of being one of the oldest and kindliest men in the whole office, a reputation which he abundantly lived up to. Incidentally, I found out later that he is one of the best lawyers in Washington. In company with him I went around to the division where I was to work, and again underwent the process of introduction, this time to the examiners with whom I was to be more intimately associated.

The division occupied three large, high studded rooms, the ceilings highly and uselessly decorated, after the manner of government buildings, while the walls were lined with file cases containing the records of the division, the tops of the cases being piled high with law books, decisions of the courts and the commissioners and a sprinkling of technical volumes.

Each room was provided with several large desks littered with papers and books, and to one of these I was assigned, being given a copy of the annotated patent laws of the United States. Here my legal education began.

At this point some idea of the division of work and the duties of the examiners may be pertinent. The office is divided into forty-one divisions, each supposed to contain all allied subjects of a certain art or branch of industry. Thus machine tools, simple tools, metal-working devices are classed in one division; surgery and undertaking are suggestively classed together; and with the same cynical wisdom bread, cakes and pies are grouped in the same division (under "plastics") with Portland cement, plaster of Paris, etc.

In addition to the forty-one divisions of legal and technical work, there are also the divisions of publication and classification. In the latter all applications for patents are casually examined, and assigned to the division dealing with the particular subject to which it relates. Within the division each examiner has a special branch or branches of work, called his "art," in which he is supposed to be especially skilled. When an application has been assigned to a particular division, the primary examiner in the latter reassigns it to the assistant examiner in whose art it belongs. The application is then called a "case," after the legal phraseology.

It now becomes the duty of the examiner to whom it is assigned to make a careful examination of the case, to see that the legal forms are complied with, that the drawings and specifications agree, and are as clear, concise and unequivocal as possible. After the examination as to form has been made, the "search" is begun. This consists in examining all previous patents in the class or sub-class of the art to which the application appertains, or closely related arts, to determine whether previous patents have been granted on the device in question. Contrary to what might be expected, the claims and specifications of previous patents are not examined in making the search (except in cases of doubt), but the drawings are inspected,

1. A paper on "Summer Experiences," read by William A. Darrah at a meeting of the Worcester Polytechnic Institute Branch, October 9, 1908. Reprinted from January "Proceedings" of A. I. E. E.

and if the claims of the applicant can be read upon these drawings, those claims are noted and rejected. Originally other sources were used in the search for anticipating references, these sources being encyclopedias, magazines, text-books and devices already constructed. However, with the growth of the office, these were gradually abandoned, and dependence placed solely upon the office records.

Having made the examination and search, the next step is to make what is called the "action," which consists in writing a memorandum in the form of a letter, stating all formal objections to the application, and the reasons for its rejection. Here the examiner has considerable personable latitude, which is frequently used as a means of disciplining unscrupulous or careless attorneys. This memorandum is handed or read to the stenographer, who makes two typewritten copies of it, one for office reference, while the other is sent to the applicant or his attorney.

If the application is not rejected and is in good form throughout, it is sent to the issue division, and after more or less "red-tape" the patent is granted to the applicant.

Naturally, and fortunately for the office, ninety per cent of the applicants are represnted by attorneys, who transact the entire legal business of the inventor very much more expeditiously and probably more satisfactorily than he could himself. It is an old saying, and one well proved by experience, that "the man who handles his own case has a fool for a client."

As the examiner is thrown much into contact with the attorneys personally, or with their cases, he very soon learns their characters and methods. And there are all classes of attorneys, from the most conscientious expert, to the charlatan, who takes the cases dropped by others. The work of the careless attorney is given a rigid examination, and no mercy shown in objecting to claims or forms, while the cases of more conscientious lawyers are less severely dealt with. This is not, as it might appear, a form of favoritism, but merely a means of causing the attorneys to prepare their own cases, instead of throwing that work upon the office, which is already overworked.

As the examiner handles applications from all kinds of people, in all parts of the world (for there are a large percentage of foreign applicants), he naturally comes across many curious errors and ideas. Thus a certain legal light from California, more versed in legal than technical details, recently presented several cases describing a "Paul and Rachel" wheel, evidently considering "pawl and ratchet" a biblical quotation. Then there is the class of attorneys, who having a marked antipathy to friction, call all pivots "anti-friction pivots," while another group of practitioners call all devices automatic. The applicants from abroad, notably German inventors who try to conduct their cases after the rules of their home office, are another group who make interesting errors. All applications must be in English, and the quaint German-English of these specifications is usually harder to read than German itself.

The Patent Office is also the hunting grounds for all varieties of cranks and freaks. The old attempts to patent perpetual-motion devices are so well known as to require little comment. They are still being presented, however, variously disguised, for the Patent Office will not accept such applications knowingly. One presented this past summer, which came to my notice, was a machine which operated by the expansive force of freezing water, which was alternately passed into two cylinders, frozen, and then forced out, thus doing work. In such cases it is the custom of the examiner to request a working model. This requirement generally silences the freak inventor.

Among the curious applications presented may be mentioned the dry process of purifying water, which consisted in "first reducing water to the solid state, crushing it to a fine powder, passing it through a fine-mesh sieve, and then, by the application of a gentle heat, reduced once more to the liquid state." The applicant was evidently used to sizable impurities.

Compared to some departments of the government, the Patent Office is remarkably free from evidences of "graft." It is worthy of note that almost any dishonest or mistaken issue of a patent can be corrected by application of the injured party to the courts, for while the commissioner of patents may not annul a patent, he may grant one of an earlier date. Not to be classed under the head of graft, is the kindness of one of the largest firms of patent lawyers in furnishing the *Scientific American*, free of charge, to all examiners in the Patent Office. Formerly boxes of cigars, complimentary railroad tickets, etc., were mysteriously circulated among the officers, from unknown (?) sources, but this practice has decreased somewhat.

The position of the examiner may need a little explanation. He is a kind of lower court; in fact, he, with the primary examiner, forms what is called the lower tribunal of the office. He examines the cases presented and requires amendments and corrections, which, if not complied with, work rejection of the application. Appeal may be taken from this decision to the examiners in chief, and from them to the commissioner, after which the case goes to the United States courts. Thus the examiner is the lowest tribunal in the series. The examiner gives hearings and interviews, and considers motions and amendments, very much as a judge of a lower court would do.

Considering the advantages of the position of examiner, they are many. It is a governmental position, hence certain for a lifetime, if desired. The work is not difficult, and is very interesting. There is considerable opportunity for outside work, as the hours are 9 a. m. to 4:30 p. m. The atmosphere of the office is most congenial, the examiners are all well-educated men, and there is an air of kindliness and good-fellowship found in almost no other occupation. The office also gives one an impression of peacefulness and contentment, as no one ever hurries through the old corridors, and each works when and as much as he wishes in a manner most restful and novel.

The principal objections to a permanent position in the Patent Office are mainly due to its permanence or certainty. The salary of the office is not large, and advancement slow, but both are certain to any man of very moderate ability. The relation of the salary in the office to the average technical graduate indicates that while the engineer starts at a lower salary, yet he eventually crosses the salary of the examiner and later considerably exceeds it.

In the matter of salary, merit and ability have little effect in government service, which rather discourages hard work. The great chance of the able man, however, is his chance to study patent law, and, eventually, after being admitted to the bar, to start in a business for himself. The income of a patent attorney is limited only by his ability. While there are a number who make a bare living, there are a large number whose incomes range from $2,000 to $20,000 per year.

CONDITIONS AFFECTING STABILITY IN ELECTRIC-LIGHTING CIRCUITS [1]

BY ELIHU THOMSON.

The term stability in this paper refers to that condition in which the current or potential, or both, remain at a steady value. Instability implies fluctuation which may arise from internal causes or be provoked by slight changes; and the fluctuations so arising may tend to be perpetuated automatically. An example of such action is the well-known "surging" in series arc-light circuits, which in the early days of development often became a difficulty.

The chief part of the present discussion will naturally have to do with the constant-current series circuits containing arc lamps operated either by direct-current dynamos, by alternating-current transformers, by reactive devices in alternating-current circuits, or by rectified alternating currents from transformers. Much that will be touched upon is already well known; but there may be some matters which are not so well known, the bearing of which may be rendered more clear. The instability due to so-called "hunting" will be left out of present consideration, which will be confined chiefly to cases in which the load conditions themselves tend to instability.

The art of electric distribution began about thirty years ago with the direct-current series arc circuit. The load was inherently unstable, owing to the peculiarity of the arc resistance falling with increase of current. This form of distribution seems destined to survive for a long period, especially for street service with the later luminous flame arcs of high economy. It will also hold its place in similar service with series incandescent lamps with metallic or other high-economy filaments, the nature of the resistance of which results in stability of current. Such a circuit as this latter is therefore outside of present consideration. Where in fact the load in a circuit is of the nature of "dead" resistance, stability is assured, provided no other disturbing causes exist, such as speed fluctuations in driving the generators. This is, of course, the case in the incandescent-lamp circuit, whether in series, in parallel, or in a combination of the two. In early continuous-current plants of small capacity, it was, however, generally easy to note the disturbances introduced by speed irregularities, or even to count the revolutions of the drivng engine, or to watch the intermittent action of the engine governor.

The coupling of machines in parallel, and the later introduction of turbine driving, have resulted in the almost complete elimination of such fluctuations, and they may, therefore, be left out of consideration as having nothing to do with inherent lack of stability or with such instability as inheres to the arrangement of the circuit itself. In passing, however, it may be remarked, that sometimes in self-excited direct-current dynamos of constant-potential type, shunt or compound, the degree of sensitiveness to speed variations may be abnormal. This sensitiveness has occasionally been noted by designers in high-speed, high-efficiency machines of moderate capacity. In such cases each slight increment of speed raises the potential and immediately reacts to increase the field strength, in turn causing a further increase, and so on. With a slight fall of speed there is, of course, the opposite effect. The difficulty is exaggerated if the engine governor is a little late in making its compensations, and they are at their worst when the iron of the machine is worked at the steep part of the curve of magnetization much below incipient saturation. The remedy for this form of instability is an alteration of proportions in the design and the removal of mechanical accessory causes. By working higher up on the saturation curve the tendency to magnification of the effects above alluded to is much reduced. The greater stability secured is, of course, purchased at the cost of more copper or a less efficient field circuit, and in a compounded machine the curve of potential regulation may not be so flat.

It is fortunate that the great fall of resistance in carbon filaments occurs only at ranges of temperature much below normal incandescence, or such lamps might become a load tending to instability, as in the case of the Nernst glower, which requires the addition of devices for securing stability of current. The metallic filament and metallized filament, having positive temperature coefficients, tend, if anything, to minimize all fluctuations, but the effect is naturally very small.

An arc started between electrodes held at a fixed distance apart and maintained at a constant-potential difference would exemplify the most unstable condition possible, but the requirement is manifestly impracticable. It would result in infinite current passing. The current would grow in value until the condition of constant-potential difference assumed ceased to exist. The condition reached would virtually be that of short-circuit. While the conditions assumed above are unrealizable, they are sufficiently approximated in practice, and they emphasize the fact of the need of some current-limiting or steadying device in circuit with the arc. Several arcs in series evidently do not change the nature of the problem. An enclosed arc gives substantially the same result.

It has been said with some truth that to design and construct a constant-potential dynamo that would work fairly well, was, even in the early years of the art, an easy undertaking as compared with the production of a dynamo to work a series of arc lights, involving a peculiar and little-known proportioning to secure stability of current in working a load so inherently unstable. The problem was not only this, but the stable current value had to be such as was proper to the machine, one which did not involve a destructive rise of temperature in the windings; and, on the other hand, one which was not so small in value as to involve such low temperatures in the windings as to indicate that the material was not being used at or near the maximum effectiveness.

It may be instructive to trace briefly the history of the development which preceded that of the constant-potential dynamo. Early in 1879 there existed arc machines working at about ten amperes with a dozen or more arc lamps in series, the arc pressure being about forty-five to fifty volts per lamp. The carbon-filament incandescent lamp was not brought out until about the beginning of 1880. It is well known that the original dynamos in service for arc lighting, excepting a small number of lighthouse plants, operated with the permanent-magnet field (Holmes and Alliance machines), were constructed to work only a single arc with commutated direct current. Such were the Gramme machines of 1876, the Wallace of the same date, and the Siemens and Brush machines of a year or so later. The arc voltage was the same or nearly the same in these, but the current, according to the size of the machine, varied widely, being in some as low as ten amperes and in others as high as thirty or forty, or more amperes. While the current values varied somewhat as the single arc burned with varying separation of its carbons, the current at any time was stable,

1. Abstract of a paper read before the American Institute of Electrical Engineers, New York City, January 8.

without surging or fluctuations, such as might have been expected from the nature of the arc resistance, which was substantially the only resistance in circuit. But there were elements of compensatory character present in the circuit. As the current in an arc increases, the section of its hot gaseous conducting flame likewise increases; the resistance falls as more material is volatilized, and more ions are furnished to conduct the current, unless at the same time the length of the arc itself be increased to compensate therefor. Most of the early arc lamps used with these machines possessed the feature of automatically lengthening and shortening the arc following the current changes in the arc-separating lamp magnets, this tending to regulate and keep constant the current strengths. The lamps were in fact called "regulators." But while this "floating arc length," as it may be called, assisted in securing stability, it would not have been of itself sufficient in the absence of other causes. It would have been too late in its action and of insufficient range.

When we examine the conditions of the circuit in these early machines, we find a large relative resistance in the circuit with the arc. As an example, a small Gramme machine of 1877 had a total circuit resistance, including its arc, of 3.66 ohms, only 1.87 ohms being in the arc; the internal and external resistances were nearly equal. This relation of resistances would of itself be ample for securing stability of current, except that the dynamos being series-field excited, were of a nature to enhance current variations in the circuit by such variations reacting at full value through the series field. The machines would on this account be more likely to have unstable current. We now know that in such cases the high armature reaction allowed, and the amount and kind of iron and its nearness to saturation, were potent factors in the stability which existed. At the time these machines were designed very little was known of these matters, and the success obtained must have been largely the result of "cut and try," the experimental method. It was certainly easy to make the mistake of using too heavy iron sections, less armature reaction, less saturated field, with the result of using much less copper, and obtaining even a more efficient machine for an equal energy output, and a better design if it had to work over dead resistance, but one which with an arc for its external work or load would not attain stability in current until the value was so large as to overheat and destroy the structure in a short time. The problem was the more difficult when later it was to be designed for a series of ten or more arcs, for in that case the steadying effect of internal resistance, so potent in the case of the single-arc machines, could no longer be counted upon, such resistance falling more and more in relation to the external resistance with the size and increased capacity. In machines of thirty to forty arc lights capacity in series, the external resistance might bear to the internal a relation of approximately ten to one. There still remained the regulating effect of the lamp magnets giving a "floating arc length," and this action of the so-called regulators or lamps was the more important, as in the larger machines the time-constant of the circuit increased, giving more time in which the lamps could act to extend and shorten the arc lengths. When surging or instability took place it was marked by a lower rate of variation in the large machines than had been the case in the smaller ones, and consequently the period in which the lamps could act was more favorable. In series dynamos of large size the field-magnet reactance is naturally large, and mechanical adjustments of arc length were possible on account of the resultant sluggishness of the current variations indicating instability. There was, however, a more important property, the full significance of which was only realized at a later date.

Dr. John Hopkinson, in 1879, called attention to the method of plotting curves, afterward called "characteristic curves," by Marcel Deprez. It was shown that by a study of the characteristic of a series dynamo the condition of stability or instability of current when working an arc in its circuit could be predicted. It is not necessary to repeat the work done by various investigators in the study of these curves. Suffice it to say that the conclusions as to instability are evidently modified somewhat under the conditions above pointed out, where the circuit has high reactance and there is time for the lamp mechanism to act in changing the resistance in circuit—increasing it when, owing to an increase of current, it tends to fall in the arc, and decreasing it when the current tends to die out, owing to the higher arc resistance which follows a diminished arc current.

At one time series direct-current circuits made up of what were known as "short arcs" as distinguished from "long arcs" were employed in lighting to a considerable extent. In these short arcs the carbon electrodes were run so close together that there was but little appearance of any arc-stream between them. The arcs were hissing arcs, giving out continually a frying sound, and frequently dropping out mushrooms of graphitic carbon, which accumulated on the negative or lower carbon. The light itself was yellowish and came largely from the highly heated ends of the carbons next the slight separation or imperfect arc. In practice the current was about double that of the normal long arc; the voltage at the arc was about one-half.

So far as stability is concerned, however, since the lights were in considerable measure like dead resistances, it was far more readily obtained; it did not depend to such a large degree on the characteristic of the dynamo. So far as the writer is aware, these short arcs or semi-incandescent arcs were the only ones ever successfully run in series on shunt-excited arc dynamos; machines in which the proportioning was much more easy and more akin to that of constant-potential types. Despite the fact that a greater efficiency in the dynamo itself could be reached, the system gradually went out of use.

[To be concluded.]

Great Western Power Company Plans Million Dollar Steam-Turbine Plant at Oakland, Cal.

The Great Western Power Company has completed its plans for the erection in Oakland of an electrical generating plant to cost about $1,000,000. The proposed plant is to be used as an auxiliary to the company's hydroelectric station at Big Bend, Cal. The new station is to be built at Session's Basin, on tidewater. The plant will be modeled somewhat after the Fisk Street station of the Commonwealth Edison Company, Chicago, employing 15,000 kilowatts capacity in steam turbines. It is planned by the company ultimately to double this capacity. This will be the first steam-turbine plant of the magnitude in California. It will be equipped for burning oil, and it is expected that it will be ready for operation within seven months after the work of construction is commenced. As a preliminary step to the construction of the second unit of its string of power plants along the Feather River, the Great Western Power Company has closed some options and taken others at Big Meadows, Plumas County. A.

The Chicago Electrical Show.

Fourth Annual Exhibition of the Electrical Trades Exposition Company at the Coliseum, Chicago, January 16-30.

Preparations have been completed for the fourth annual electrical show, under the auspices of the Electrical Trades Exposition Company, which will be held at the Coliseum, Chicago, from January 16 to January 30. Every available square foot of space has been taken, and the list of exhibitors is the most representative of all the shows this company has so successfully exploited. One feature wherein this year's show will differ from former ones is in the fact that many of the displays will be working exhibits, many of them industrial in character. The Commonwealth Edison Company has made elaborate plans along these lines and will have a particularly live display. In looking over the list of exhibitors, however, it would seem that not a line has been overlooked that would tend to make the exposition, as a whole, comprehensive and generally representative of the electrical industry and science.

One particularly important exhibit, in which the management takes no little pride in the announcement, is that of the United States Government, which will occupy the entire Coliseum Annex with a display of electrical machinery and apparatus, such as is used in the equipment of one of the $7,000,000 modern battleships. Six hundred thousand dollars of this is spent with electrical manufacturers. Assistant Manager John J. Schayer, of the Electrical Trades Exposition Company, of which Samuel Insull is president, and Homer E. Niesz, manager, had a conference with Lieutenant-Commander E. T. Witherspoon, in charge of the Chicago and Milwaukee naval recruiting stations, and Captain Warren F. Purdy, commander of the Illinois Naval Reserves, each of whom indorsed the proposition. Captain Purdy and Mr. Schayer went to Washington two weeks ago and enlisted the services of Congressman Foss, chairman of the Naval Affairs Committee. When the matter reached Secretary of the Navy Newberry it was found that he was heartily in sympathy with the proposition and immediately wrote an official order for the Bureau of Navigation to assemble the display for the Chicago show.

While this exhibit will be of great interest to the electrical trade as a whole, Secretary Newberry believes that it will be of benefit to the naval department in the general way of educating the public as to the development of modern warship construction and will greatly aid in the recruiting service by illustrating the technical training to be obtained in the naval service.

The scheme of decoration for this year's show is going to be fully as elaborate and costly as that of last year. The same booths will be employed, but the roof interior will be completely changed, and particularly unique in its plan and design. The illuminating features will include 10,000 tungsten lamps in arches over the aisles from booth to booth.

The following special souvenir and convention days have been arranged:

Saturday, January 16—Opening Day.
Monday, January 18—Souvenirs.
Tuesday, January 19—Army and Navy Day.
Wednesday, January 20—Chicago Electric Club Day (souvenirs).
Friday, January 22—Northwestern Electrical Association Day.
Saturday, January 23—Students' Day.
Monday, January 25—Souvenirs.
Tuesday, January 26—Telephone Day (souvenirs).
Wednesday, January 27—Sons of Jove Day.
Thursday, January 28—Thomson-Houston Day.
Friday, January 29—Theatrical Day.

The manufacturers will be represented as follows:

The Allis-Chalmers Company, Milwaukee, Wis., will exhibit an induction motor-generator set of fifty-kilowatt capacity, a line of standard induction motors for alternating current and the new type K motors for direct current, various sizes of power and lighting transformers, a motor-driven centrifugal pump, blading and other parts illustrating the construction of its steam turbines and generators, a motor-driven air compressor and representations of various kinds illustrating the fact that the company builds complete power and electrical machinery for every service, including, in addition to steam turbines, gas engines, Corliss engines and hydraulic turbines. The exhibit is to be in charge of C. A. Tupper, advertising manager, and among the representatives present will be President W. H. Whiteside; W. S. Heger and M. C. Miller, assistants to the president; L. F. Bower, first vice-president; Henry Woodland, second vice-president and treasurer; J. R. Jeffrey, assistant manager, steam and electrical department; E. T. Adams, manager gas engine department; W. J. Sando, manager, and L. E. Strothman, assistant manager of the pumping engine and hydraulic turbine department; George C. Forgeot, manager of works; Max Rotter, in charge of steam turbine engineering; W. W. Powell, in charge of electrical engineering; James W. Gardner, manager, Chicago district office; L. M. Harvey, manager, Milwaukee sales office, and the following salesmen and engineers: E. M. Gerry, C. A. Bickel, A. N. Brown, R. B. Williamson, L. E. Bogen, B. Frankenfield, W. C. Robinson, R. Dill, W. S. Bishop, Russell Bower, J. R. Ferguson, W. H. Yates, J. M. Kingsbury, G. S. Burdick, W. G. Hammond, R. F. Smith, A. H. Wyman, J. S. Jackson, F. L. Neely, William R. Crawford, I. L. Dimm, E. A. Wright, M. L. Embrey, R. T. Herdegen, C. D. Lutton, S. R. Kerr, C. S. Buell, Ervin Dryer, J. M. Denniston, D. K. Chadbourne, H. I. Keen, A. W. Catlin, Charles M. Howe, R. H. Gaither, C. M. McDonald, C. M. Nicholson, L. St. J. Smith, H. A. Balding, W. J. Bishop, C. E. Searle, D. P. Davies, R. D. Tomlinson, L. C. Marburg, Willis Collins, C. A. Shearer, P. A. Himes, Alfred Ernst, E. W. Tucker, C. B. Flory, W. F. Uhl and Charles C. Tappan. The company's booth will be tastefully decorated, the effect to be enhanced by palms, ferns, cut flowers, etc., and there will be ample seating capacity for those who may wish to rest.

The American Electric Fuse Company, Muskegon, Mich., will exhibit a full line of lightning arresters, both aerial and switchboard types, in operation, including the No. 600 arrester, which embodies a couple of coils which act as retardation coils as well as making the arrester self-cleaning; also a full line of fuse blocks, wire joints, test connectors, paper sleeves and pot-heads, including the paper cable pot-heads; a full line of pole terminals both in the pot-head type and those requiring no pot-head; a complete showing of distributing frames for small exchanges and a full line of telephone protective apparatus; the Allen-Bradley motor starters and controllers, in which the medium of resistance consists in the variation in pressure on a pile of carbon discs; American black enameled wire, the American Igniter, which is a self-contained timer, coil and distributor protected by a dust, heat and moisture-proof case, and designed to be mounted directly on the timer shaft of a gasolene motor for either automobile, marine or stationary service. These igniters will be exhibited in operation on vertical, revolving spindles driven by electric motors. The company will be represented by its president, F. G. Jones, assisted by G. W. Rodormer, R. C. Da Costa and G. Padley.

The Autolectric Sign Company, Chicago, will exhibit principally translucent

art glass signs perfectly illuminated with one light; also a display of art glass shades used in show windows for advertising purposes. In addition to this there will be a color-changing sign. John Nelson will be in personal charge of the exhibit, assisted by Miss Ruth Knuckey.

F. B. Badt & Company, Monadnock Block, Chicago, the well-known electrical and mechanical engineers, will be well represented at the electrical show in their different lines, exhibiting the familiar claimed to have all the advantages of the best types of flaming arc lamps known, besides many features entirely novel and representing improvements in the art. For the convenience of the company's customers and friends there will be carried a comprehensive stock of imported Excello flaming arc carbons for all makes of flaming arc lamps.

The Benjamin Electric Manufacturing Company, Chicago, will show all of its principal devices: A number of display pany's well-known fixture studios on Fifth Avenue. A complete line of P-M fixtures manufactured by the Price-McKinlock Company, Boston, will be exhibited, and will consist of lighting fixtures showing unusual detail in design, workmanship and material. A large number of special creations and developments of latest discoveries in etched metal and galvano work applied to artistic lighting effects will also be a feature of the exhibit. An entirely new feature will be the presentation

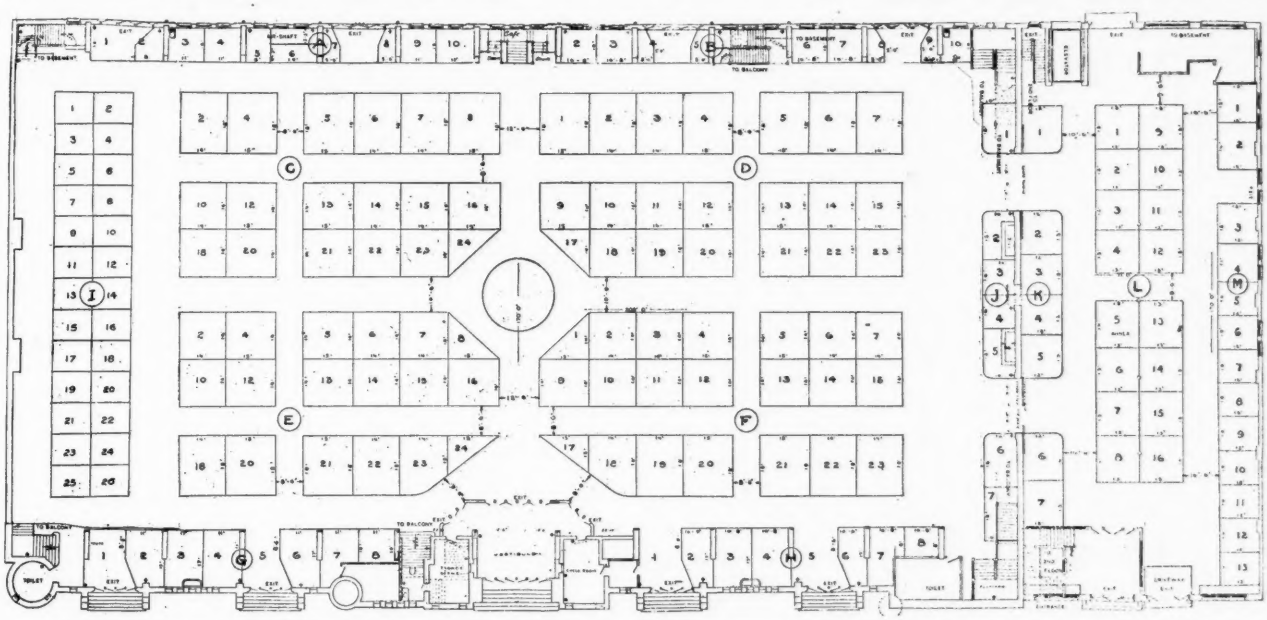


DIAGRAM OF LAYOUT OF EXHIBITORS' BOOTHS, FOURTH ANNUAL ELECTRICAL SHOW, COLISEUM, CHICAGO, JANUARY 16-30.

Appleton Electric Company—A, 6.
Autolectric Sign Company—B, 6.
American Steel and Wire Company—D, 17-18.
American Electric Fuse Co.—F, 6.
Allis-Chalmers Co.—F, 17-18-19.
American Automatic Advertising Company—H, 7.
Attractograph Co.—F, 22 (W. ½).
American Ironing Machine Company—D, 6 (W. ½).

Benjamin Electric Mfg. Co.—A, 9.
F. B. Badt & Co.—A, 7.
Malcolm H. Baird—H, 2.
Baker Electric Vehicle Co.—D, 15.

Crane Company—D, 1.
Commonwealth Edison Company—I, 1-26, inclusive.
Chicago Fuse Wire & Mfg. Co.—D, 2 (W. ½).
Central Electric Co.—B, 2-3-4.
Chicago Pneumatic Tool Company—E, 5-6.
Crescent Company—A, 4.
Cyclone Vacuum Cleaning Company—A, 2.
Cyphers Mfg. Company—D, 22-23.
Collins Wireless Telephone Company—F, 14.
Chicago Telephone Co.—D, 19-20.
Colonial Art Glass Co.—G, 3-4.
Connersville Blower Co., The—F, 3.
Caloric Co., The—E, 18 (E. ½).
Commercial Appliance Company, The—A, 8.
Cutler-Hammer Co., The—A, 10.

Del Sales Company—A, 5.
Duntley Mfg. Company—C, 23-24.

Electrical World—F, 21 (W. ½).
Electrical Record—E, 20 (E. ½).
Electrocraft Publishing Co.—H, 8.
Electric City Pub. Co.—C, 2-3.
Electrical Testing Laboratories—C, 7-8.
Electric Storage Battery Co.—F, 5.
Electric Suction Sweeper Co.—C, 21.
Electrical Age—H, 6.
Englewood Electric Supply Company—A, 4.
Electric Cleaner Company—J, 1.
Electrical Review Publishing Company—E, 12.
Electric Appliance Co.—E, 8-16.
Excello Arc Lamp Co., The—F, 4.

Ft. Wayne Electric Works—C, 13.
Federal Electric Company—J, 3-4.

General Electric Co.—F, 1-2-9-10.
Thomas Graham—J, 7 (E. ½).

Hahl Automatic Clock Co.—F, 20 (W. ½).
Hurley Machine Co.—D, 5 (E. ½).
Hinde & Dauch Paper Co.—D, 21.

International Correspondence Schools—J, 2.
Illinois Electric Renovator Sales Company—E, 4.
Indicator Electric Co. (not incorporated)—D, 5 (W. ½).

H. W. Johns-Manville Co.—E, 15.

Kellogg Switchboard and Supply Company—F, 15.
Mathias Klein & Sons—E, 20 (W. ½).
A. W. Kratz—D, 3 (E. ½).

Lindstrom, Smith Co.—F, 23.

Murphy Electricity Rectifier Co.—C, 4.
Manhattan Electrical Supply Company—F, 13.
McRoy Clay Works—F, 21 (E, ½).
Mechanical Appliance Co.—D, 7.
Mears Ear Phone Co—B, 8.
Mechanical and Electrical Mfg. Co.—D, 5 (W. ½).
Monarch Vibrator Co.—J, 7 (W. ½).

National Battery Company—C, 22.
National Electric Lamp Association—E, 21-22-23-24.
National Acme Mfg. Company—F, 22 (E. ½).
Northern Electric Mfg. Co.—E, 7.
North Shore Electric Co.—E, 10.
Chris S. Neville & Co.—B, 5½.
National Carbon Co.—D, 6 (E. ½).

Pyro One Light Electric Sign Co. of Illinois—B, 10.
Perfection Vacuum Cleaner Company—E, 2.
Popular Electricity Pub. Co.—D, 4.
Peerless Light Co.—G, 7.

Palm Engineering Co.—A, 3.
Pacific Electric Heating Co.—G, 8.
Pelouze Electric Heater Company—E, 18 (W. ½).
Phœnix Glass Company, The—D, 2 (E. ½).

Robbins & Myers Co., The—C, 12.
Red Cross Antiseptic Co.—J, 6.
Roth Bros. Company—F, 7.

Shelton Electric Company—C, 16.
Stoltz Electrophone Company, The—F, 20 (E. ½).
Stromberg-Carlson Telephone Mfg. Company—E, 13-14.
Swedish-American Telephone Company—D, 13-14.
Swedish Electric Vibrator Company—D, 12.
Simplex Electric Heating Company—C, 10-18-20.

Telephony Publishing Co.—C, 2.
Taussig & Babcock—B, 5.
Thordarson Electric Mfg. Company—F, 11.

United States Navy—Annex.
United Pump and Power Co.—D, 9.

Wagner Electric Mfg. Co.—D, 10.
Western Insulation Company—J, 5.
Westinghouse Electric and Manufacturing Company—C, 5-6.
Western Electric Company—D, 11.
Weinsheimer Company, The—B, 9.

types of Weston instruments in addition to new designs, viz., the direct-current "Eclipse" instruments, the new type of alternating-current instruments, both of the switchboard and portable types; also Ward Leonard rheostats, particularly the new type of Ward Leonard meter-testing rheostats, and Ward Leonard starters and controllers. The "Polar" flaming arc lamps, which so far have not been exhibited in the West, will be shown. These lamps are boards showing wireless clusters; various forms of tungsten arcs; adjustable socket clusters; general lighting specialties. Among those who are to be present are the following: G. C. Knott and H. E. Watson, salesmen; W. D. Steele, general manager; A. N. Fox, manager publicity department.

The Central Electric Company, Chicago, will devote its exhibit principally to illumination, patterned after the com- of the newly developed "Opalux" shade for use with tungsten lamps. This new development in lighting is considered one of the most important of the year and will be of much interest to those called upon to use or install tungsten lamps. The results of extensive and exhaustive tests have been incorporated in a complete set of curves which will be distributed in bulletin form during the show. A decidedly new device to be shown and

operated during the show will be the "Tungstometer," which is a pocket portable instrument intended to be inserted in lamp sockets and indicate directly the wattage or ampere consumption of the lamps as may be desired. The improved Central "Tungstolite" will also be exhibited and its illuminating value compared with other forms of illumination. A complete exhibit will be made of various types of Siemens' flaming arc carbons. In one section will be shown a complete line of remote-control switches, meter connection blocks, ground clamps and other devices which have been developed by the Price-McKinlock Company, a subsidiary manufacturing company controlled by the Pettingell-Andrews Company, Boston, and the Central Electric Company, Chicago. Of the well-known specialties of the Central Electric Company will be exhibited Okonite wires, tapes, etc.; Columbia, tungsten, tantalum and carbon lamps; D. & W. fuses; "Delta-beston" wire and Pittsburgh transformers. The following representatives will be present at the show: George A. McKinlock, president; Charles E. Brown, secretary; H. W. Young, sales manager; H. M. Livor, manager fixture studios; J. E. Livor, manager Price-McKinlock Company; A. S. Pearl, manager specialty department; H. Caird, manager street-railway department; J. E. Ham, manager wire department; J. M. Lorenze, Louis Raggio, D. C. Penniman, W. D. Dunsmore, W. H. Pearl, B. M. Ayres, G. E. Sturgeon, B. J. Kacin, Frank Kennedy, W. C. Halsey, R. L. Kimble, C. C. Dawson, F. B. Switzer, A. L. Hancock, Louis Privat and R. L. Sparks.

The Chicago Fuse Wire and Manufacturing Company, Chicago, will have on exhibition a complete display of its entire line of enclosed fuses, including National Electrical Code and Old Code types in all capacities from one to 1,000 amperes, and the various standard voltages met with in commercial transmission, also the company's well-known fuse wire, fuse links and fuse strip, the display of fuse cutouts including the entire line of National Electrical Code cartridge fuse bases, which are particularly neat in design and liberal in their allowance of metal for the different parts to insure against any rise in temperature because of small contact; outlet boxes and covers and switch boxes, including not only sectional gang-switch boxes, but also a complete line of outlet boxes and various covers, designed to meet special requirements of contractors. Besides the black enameled boxes there will also be on exhibition outlet boxes and covers that are sherardized, this being the new process of galvanizing, which this company has been licensed to employ. The representatives at the booth will be A. S. Merrill, general salesman; Milton Mill, of St. Louis, Mo., who represents the southwestern territory; assisted by W. W. Merrill, manager; C. T. McDonald, electrical engineer; George C. Reid, advertising manager; C. E. Harland and W. D. Dana, special salesmen.

The Chicago Pneumatic Tool Company, Chicago, will show its complete line of portable electric tools, comprising drills of from five-sixteenths-inch to three-inch capacity, portable, stationary and tool post grinders, electric hoists, portable street-railway drills and grinders. These tools will be shown in operation on direct current and alternating current. One of the tools of especial interest will be the Universal electric drill, which runs on either direct or alternating current without any change whatever in the winding of the tool. The company will also show some of its representative pneumatic tools, such as hammers of various types, drills, etc. It will be represented by C. B. Coates, Edward Aplin, W. C. Walker, John C. Campbell and G. W. Parker.

The Chicago Telephone Company will make a display of telephone-exchange apparatus as it appears in actual operation. The largest-sized multiple board now built will be installed in two sections, employing six operators, with supervisors, chief operator, etc., just as in the company's exchange offices. The lighting of the miniature call lamps, the answering of calls by operators, and completing of connections in the multiple sections will give practical demonstration of telephone-exchange work just as it is carried on. In addition, there will be demonstration of long-distance service throughout the country from booths located in the telephone sections, and complimentary service will be had with many points outside of the city.

The Commercial Appliance Company, Chicago, will exhibit the "Germless" glass telephone mouthpiece, and will be represented by M. M. Wood, Harry S. Conover and G. W. Conover.

The Commonwealth Edison Company, Chicago, will install an industrial power exhibit, showing the actual operation of quite a number of unique types of machinery.

The Connersville Blower Company, Connersville, Ind., will show the devices which it has developed for use in vacuum cleaning, together with small vacuum pumps and blowers. The intention is to demonstrate the efficiency, capacity and utility of these devices in a practical way. This exhibit will be in charge of Worth W. Preston, the sales manager of this branch of the company's business, who will be assisted by engineers and demonstrators.

The Crescent Company, Valparaiso, Ind., will exhibit a line of Crescent specialties, including the "Loxon" lamp guard, "baby" torches, portable lamp guards of various styles, and Harter clusters. The representatives in attendance will be J. H. McGill, manager; A. O. Einstein, sales manager, and F. W. Nind.

The Cutler-Hammer Manufacturing Company, Milwaukee, Wis., will devote its exhibit entirely to its line of push-button switches and sockets. None of the company's numerous lines of motor-starters and speed regulators will be shown in its own booth, but these devices will be in evidence in other exhibits, being shown in connection with the exhibits of motor manufacturers and motor-operated machinery. At the entrance to the Cutler-Hammer booth will be a large working model of the company's push-button switch enclosed in plate glass, so that the operation of the simple, three-piece mechanism may be plainly seen. On pushing the mammoth push-button a row of incandescent lamps will flash their rays onto a sign at the back of the booth. Numerous lamps and electroliers installed in the booth will serve to illustrate the practical applications of Cutler-Hammer push - button specialties. Push - button porcelain lamp sockets will be shown in connection with tungsten lamps, the operation of the push-button lighting the lamp without tilting it or jarring the delicate filament. A two-circuit pendent switch will be shown in connection with an eighteen-lamp electrolier, one button controlling six lamps and the other twelve, thus making it possible to obtain by means of a single switch three degrees of illumination—six, twelve or eighteen lamps, the full candlepower of the electrolier being obtained by pressing both buttons. This same two-circuit switch is also shown in connection with an electric fan and lamp, each being separately controlled by different buttons of the same pendent switch. Several new devices will also be shown, among these being a flush switch which will be shortly placed on the market. This switch has the same simple mechanism as the other devices, the elimination of a multiplicity of parts, enabling the manufacturer to meet the modern demand for a really shallow flush switch. Electric candelabra equipped with tiny push-button switches will be exhibited, and a number of photographs and colored drawings illustrating various applications of Cutler-Hammer push-button specialties will add to the attractiveness of this booth. The representatives in attendance will be R. M. Van Vleet, R. I. Phillips, Horace L. Dawson, Charles J. Klein and H. P. James.

The Duntley Manufacturing Company, Chicago, Ill., will have on exhibition a very complete line of new standard vacuum cleaners and sweepers. The line of goods it will exhibit will be confined to portable vacuum cleaners, electrically driven. There will be four different sizes, Nos. 1, 2, 4 and 5, weighing, respectively, forty-eight pounds, thirty-five pounds, twelve pounds and ten pounds. The Nos. 1 and 2 are equipped with chrome leather diaphragm pump, novel and convenient dust-separating arrangement, and with a Universal motor of one-sixth horsepower. This motor will operate on either alternating or direct current, and in alternating on any frequency between twenty-five and eighty cycles. The entire machine is contained in a double-walled metallic case, cylindrical in form, with convenient

handle at the top. On account of its shape, size and weight, the cleaner is as easily lifted and carried around from one room or floor to another as an ordinary bucket. The vacuum developed is from five to eight inches, with an air displacement of twenty-five to thirty cubic feet per minute. Each machine is equipped with a twelve-and-one-half-foot length of hose, ready to be attached to the machine and cleaning tools, and a twenty-foot length of electric cable and attaching plug. The hose can be instantly converted by the use of an extra attachment, to utilize the exhaust of the machine for blowing the dust out of radiators, and places that cannot be reached by the ordinary vacuum tools. The tool equipment consists of one two-piece renovator handle, nickel-plated and handsomely finished; one nozzle for drapery and furniture; one brush for walls, pictures, woodwork, etc.; one ten-inch maple-face nozzle for carpets, rugs, etc.; one ten-inch felt-face nozzle for bare floors. The machine can be safely operated from any lamp socket, and the current consumption comes within safe practice, and the requirements of the insurance companies. By the use of a one-sixteenth-horsepower motor, located in the No. 4 and No. 5 types, together with a pump and dust separator, this little device is easily moved over the floor surface, and is extremely efficient and convenient. It is intended to be used for floor sweeping only. The company's booth will be located in the centre of the exhibit space, and will be in charge of B. E. Harris and H. L. Lanphear, sales managers, assisted by a competent corps of demonstrators.

The Electric Appliance Company, Chicago, will have the following specialties on exhibition: Sangamo direct-current integrating wattmeters, alternating-current integrating wattmeters and ampere-hour meters, Packard tungsten lamps and transformers, "Paranite" rubber-covered wires and cables, "Eureka" massage vibrators, American Electrical heating apparatus, Faraday signal bells, "C. & S." intercommunicating telephones. There will be shown the Sangamo ampere-hour meter for use with storage batteries. This meter is particularly adapted for electric vehicles, train lighting and central station storage batteries, as it is said to be the only instrument at present on the market that indicates just how far the battery has been discharged. It also indicates in a backward direction while the battery is being charged, so that the operator knows how far to go in charging the batteries. The representatives who will be in attendance during the show are as follows: P. R. Boole, general sales manager, F. J. Alderson, F. D. Schwartz, R. S. Mitten, H. N. Remington, J. K. Alline, J. B. McMullin and E. R. Field.

The Electric Storage Battery Company, Philadelphia, Pa., will exhibit samples of its varied line of storage batteries for all purposes, including Chloride Accumulator, Types G, F, E and D in lead-lined and glass tanks for electric lighting, railway and telephone work. A conspicuous feature will be a large photograph of the 10,000-ampere Chloride Accumulator battery the company has recently installed at Plymouth Court, Chicago, for the Chicago City Railway Company in connection with its rehabilitation scheme. This battery relieves the railway system's morning and evening peaks. For railway car lighting the company will show its Manchester box and Tudor rolled combinations in jars and lead-lined tanks. For railway signal and telegraph work smaller types of the Chloride and Exide plates will be shown. The Exide plates used by the vehicle manufacturers for electric vehicle and sparking work will be shown in various sizes and methods of assembling. This type is now largely used for the lighting of vehicles of all types. The company will be represented by Godfrey H. Atkin, manager Chicago office; J. M. S. Waring, district engineer; H. B. Marshall, F. T. Rinder, J. N. Rosholt, George Neth and H. M. Beck.

The Excello Arc Lamp Company, New York city, will exhibit its standard type lamp, both alternating and direct current, as well as its new 1909 type with prismatic inner globe and ventilating ash-pan. The company will give demonstrations and explain the operation of its lamps to visitors. The following staff will be in attendance: H. M. Hirschberg, president; G. W. Armstrong, manager; H. W. Fowzer, T. W. Hall, H. F. Kunzer and W. J. Gille.

The Fort Wayne Electric Works, Fort Wayne, Ind., will exhibit a fairly complete line of its main manufactures, including samples of its alternating-current generators, motors, arc lamps, integrating wattmeters, transformers, fan motors, etc. In addition it will have connected up and in operation a new device, the "Compensarc," used for controlling moving-picture machines when operated on alternating current. This device has just recently been placed on the market, and has the following advantages over the resistance controller or rheostat ordinarily used in this work: It will, it is stated, effect a saving of sixty-six and two-thirds per cent in bills for electricity over and above the ordinary resistance controller; it runs very cool and precludes absolutely any chance of fire resulting from overheating; the fact that it operates with a minimum rise in temperature adds to the comfort and convenience of the operator; it is extremely simple and safe to operate and has been approved by the Board of Fire Underwriters and the Chicago City Department of Electricity. In attendance at the show will be: W. S. Goll, W. S. Hine, A. L. Pond, L. A. Carr, F. S. Wiemeyer, A. J. Francis, W. H. Eicher, H. Plumley.

The General Electric Company, Schenectady, N. Y., will occupy a space of about 800 square feet in the centre of the Coliseum, which will be devoted entirely to tungsten lamps and heating devices. Comparative tests will be made between tungsten and carbon-filament lamps of various sizes, showing the relative current consumptions and light-giving qualities of the two types of lamps. As usual there will be a demonstration of electrical cooking and heating devices.

The Hahl Automatic Clock Company, Chicago, will exhibit its pneumatic clock system, programme clock, self-winding electric clock and time stamps. The master clock, a chronometer of astronomical accuracy, is equipped with self-compensating pendulum beating seconds and propelled by a spring automatically wound at the end of every minute; it is also equipped with self-contained power device and operates all secondary clocks by alternate impulse and release of air under a pressure of less than one ounce. No auxiliary apparatus of any kind is required and motive powers employed being gravity and free atmosphere only, any and all cost of operation is eliminated under the system, which is valuable wherever the use of a number of clocks showing absolutely correct and uniform time is required, such as public buildings, factories, hospitals, schools, residences and apartment buildings. The Hahl system has been installed in many of the most prominent buildings of the Middle West. The same master clock employed under the pneumatic system may be equipped with programme apparatus, ringing gongs by electrical contact at any one-minute interval. Signals of any duration may be given.

The Hinde & Dauch Paper Company, Sandusky, Ohio, will exhibit a full line of its corrugated fibre goods for packing fragile articles. The company has contracts with many lamp manufacturers, and is now adapting its line of special improved corrugated fibre boxes to supply suitable containers for all small electric apparatus. It is about to introduce a patented box as container for tungsten lamps. E. J. O'Hagan, E. J. Eiserman and Mr. Becker will be in attendance.

The Hurley Machine Company, Chicago, will exhibit the "Thor Electric" washer and wringer and a new device to be used in connection with the machine, viz., a universal joint which goes on the flywheel of the washer and on the crank of any standard article found in the house, such as an ice-cream freezer, churn, meat chopper, ironing machine, cream separator, grinding stone, buffing wheel for cleaning silver, emery wheel for sharpening knives. Any of the above articles can thus be run from the same motor that is used with the washer and wringer. The following will represent the company: Neil C. Hurley, B. G. Tompkins, A. J. Fisher, A. E. Carmichael, M. Y. Steen, E. J. Riedy, N. H. Haherle, Arthur Kee, Richard Ruffo, Miss A. McIver and Miss J. Erickson.

The Illinois Electric Renovator Sales Company, Chicago, will have on exhibition "Invincible" electric renovators. The exhibit will be in charge of H. E. Poffin-

berger, general manager of the company, assisted by the local representatives and the representatives from the Milwaukee agency, and from time to time the company's various other agencies located in different parts of this territory. It will also be assisted somewhat by representatives from the Pittsburg, Minneapolis and St. Louis, and possibly a number of the other sales companies located in different parts of the country. Practical demonstrations will be made of the various uses of the "Invincible" electric renovator, as found in use not alone in Chicago, but in every section of the country, in residences, hotels, office buildings, theatres, churches, hospitals, sanatoriums, department stores, schools and colleges, public buildings, libraries and many other places where special conditions are successfully met.

The International Correspondence Schools, Scranton, Pa., will display their textbooks on a number of different courses of instruction; volumes of their Technical Library, and a revolving globe showing the different countries in which they have students. This globe, with a miniature passenger train running around it, operated by a motor, will be used as an attraction. Those in attendance will be C. C. Marson, J. E. Mellon, W. G. Jones, J. B. Kevan, V. C. Curtis and J. E. Freelove.

The exhibit of the H. W. Johns-Manville Company, New York city, will be shown up to excellent advantage by means of the "Linolite" system of lighting, which proved so interesting at the show last year. "Linolite" consists of a tube enclosing a straight filament, and is rapidly being adopted for practically all kinds of illumination. The lamps are arranged end to end and a properly designed polished reflector enables the light to be distributed uniformly over any desired area. Heretofore, its use has been more or less limited to the illumination of show windows, show cases, bulletin boards and signs, but a new line of handsome portable desk and table lamps and picture reflectors has just been placed on the market. "Linolite" lamps are made with carbon filament, sixteen candlepower, and also may be had in larger units, such as thirty-two candlepower, with metallized filaments. The well-known line of "Noark" enclosed fuse material will enjoy its usual prominence in the exhibit, with the addition of a new and complete line of National Electrical Code Standard service switch fuse boxes, equipped with interchangeable conduit fittings, which render them suitable for any form of installation. The switch box cover is provided with a handle simultaneously actuating the steel fuse carrier hooks within the box superseding the fibre lobster claw arrangement formerly employed. The boxes are made in capacities up to 400 amperes, two-and-three pole, for 250-volt and 600-volt service. The new J-M catenary line material is attracting considerable interest. This includes a new and complete line of porcelain strain insulators, steady braces, messenger insulators, bracket arms, anchorages, pull-off clamps, studs and hangers, section insulators, wood strain insulators, etc., for line potentials of 11,000 volts and under. Asbestos wood, a fireproof material, which it is stated possesses higher electrical-resisting properties than slate, marble or fibre, will also be shown. It can be furnished in any color, or grain, and takes a higher polish than finished wood. It can be sawed, drilled and machined, and makes an ideal material for switchboards, panel-boards, etc. The J-M immovable guy anchor is a recent addition to the company's lines. This is a mechanical anchor, which is expanded to twice its original diameter after being inserted in the earth. The exhibit also includes a very complete line of moulded mica overhead line material and fittings for low and high-tension railway service, controller parts, trolley wheels, cables, hangers and electric car heaters, a line of "Vulcabeston" and other moulded insulating compounds for every condition of electric service, and many other specialties. The following representatives will be in attendance: T. G. Younglove, manager Chicago office; H. M. Frantze, manager Electrical Department, Chicago office; J. C. Younglove, manager Railroad Department, Chicago office; H. W. Frantz, Chicago office; F. G. Simpson, assistant manager Chicago office; T. T. Lyman, manager Milwaukee office; G. A. Saylor, manager Electrical Department, Milwaukee office; J. C. Cone, Milwaukee office; F. C. Frumveller, Electrical Department, Detroit office; Bailey Whipple, general lamp agent, New York office; J. W. Perry, general manager, New York office.

Mathias Klein & Sons, Chicago, will exhibit a full line of Klein products for transmission line construction and maintenance, as well as tools of general utility to electricians, light, power and traction men. This comprises a wide variety of tools, such as climbers, splicing clamps in many styles and combinations, linemen's, wiremen's and switchboard pliers, tool belts, tool bags, tool kits, tie, splicing and lag screw wrenches, screw-drivers, cableman's tools, saws, melting pots, gasolene furnaces, torches, reel jacks, wire reels, pulley blocks, shovels, spoons, tamping and digging bars, tree trimmers, post hole augers, pike poles, and many other appliances.

A. W. Kratz, Chicago, will exhibit the 1900 electric washer with wringer attached, also an extra wringer placed on a stationary washtub; this wringer is used for rinsing. There will also be exhibited a mangle. This apparatus will all be operated by a one-eighth-horsepower motor. Mr. Kratz and his son will be in attendance.

The Lindstrom, Smith Company, Chicago, will show the "White Cross" electric hair drier, which will dry a head of hair in about six minutes; an adjustable clamp for holding this hair drier to any chair or table while in operation, and a pedestal hair drier suitable for use in barber shops and hair dressers; also different types of "White Cross" electric vibrators, operating on both direct and alternating current. A vibrating chair can be made with the aid of clamps No. 14 and No. 15 with all the company's vibrators except the No. 25 and No. 27. The vibrator is simply attached to the clamp, and the clamp is attached to any ordinary chair. There will also be exhibited physicians' "White Cross" combined galvanic and faradic batteries, and a line of therapeutic lamps for medical and bleaching purposes. The company will also have "Flash-I-Do" signs on exhibition, and the "White Cross" electric transformer, a new outfit, which can be used on either direct or alternating-current circuits for medical purposes.

The McRoy Clay Works, Brazil, Ind., will exhibit a complete line of the well-known McRoy multiple conduits, as well as single conduits of the round and square bore types. In addition to the standard three-and-one-fourth-inch sizes, the company will show this year a special small-bore duct with lighter walls, for use by companies at far distant points where clay is not obtainable for making underground conduits. The bore of this duct is two-and-one-half inches, and a great saving is effected in freight. This section is also commended for use by street railway and power companies, where it is desired to have each cable in a separate duct. The company is now shipping them to the Pacific Coast on a large contract recently secured. In addition to C. C. Baird, sales manager, the company will be represented by L. M. Christie, secretary; F. R. Greiner, treasurer; E. R. Beidler, general superintendent; A. W. Beidler, president.

The Mechanical Appliance Company, Milwaukee, Wis., will have on exhibition several sizes of three-phase induction motors, a line of self-starting, single-phase motors up to five horsepower, various sizes of direct-current motors from one-eighth to ten horsepower, vertical motors such as are used for operating laundry extractors, railway-crossing gate operated by small direct-current motors, variable-speed, direct-current motor for machine-tool service, special reversing motor, such as is used on laundry ironers, and an electrifier which is being built for the Alsop Process Company, for use in connection with its electrical flour-sterilizer and aging apparatus. J. G. Zimmerman will be in charge of the exhibit, and R. G. Kellogg, vice-president, and F. H. Ford, sales manager, will also be in attendance.

The Mears Ear Phone Company, Chicago, will exhibit its improved electrical device for the deaf. By constant experimenting, this firm has succeeded in removing serious defects and perfecting a little device, called the "Aurophone," which it claims is an absolutely reliable sound transmitter and sound magnifier, thus enabling deaf people and those hard of

hearing to hear and understand conversation as readily as those with normal hearing. The instrument is so small that it can be carried in the vest pocket or concealed within the waist. The company's exhibit will be in charge of John S. Linde, western agent, and a corps of assistants.

The National Battery Company, Chicago, will exhibit the following material: Ignition-battery materials; propulsion-battery materials, including several types of cells, separators, jars, crates, etc; car-lighting material, including crates, cells, tanks, connectors, and sample plates; stationary material, including both positive and negative groups, glass jars, wood sand trays, bolt connectors and separators. In addition to the above, there will be a board containing sample grids, plates and detailed material used in connection with all types of plates, for ignition, propulsion, lighting, power, telephone, signal, fire-alarm, etc. The following representatives will be present: E. B. Cottrill, president; Bertram Smith, manager, Chicago office; A. Otto Hiester, Buffalo office; W. F. Bauer, Chicago office; W. W. Somes, Chicago office.

The exhibit of the National Electric Lamp Association, Cleveland, Ohio, will be conducted by the engineering department of the association. The booth will be decorated with special furniture, cases and exhibition tables, and a very complete demonstration of the quality and performance of all the styles of tungsten electric lamps will be made. The arches surrounding the space will be in accordance with the general scheme of the Japanese features of the show. These arches will be outlined with tungsten lamps in Holophane reflectors. The exhibition cases will contain a complete line of tungsten, tantalum, Gem and miniature lamps, manufactured by the National Electric Lamp Association. A mineral exhibition of all the ores of tungsten and the materials which go into the finished tungsten lamp will be made. The quality of light of the tungsten lamp will be demonstrated by showcases containing carbon and tungsten lamps, throwing light on vari-colored materials in small show-windows. The proper use of light for the illumination of store windows is likewise shown. The effects of voltage and saving in current of the tungsten lamp will be shown by lamps placed upon small exhibition tables. The use of tungsten for automobile, sign, and train-lighting purposes will be demonstrated by lamps placed in fixtures in a large showcase. The booth will be in charge of P. F. Bauder, R. B. Clark and H. S. Hall, representatives of the engineering department.

Henry Newgard & Company, Chicago, will exhibit Newgard waterproof receptacles mounted on a fountain with the water running over same; also the "Wizard" medical battery and other specialties, such as panel boards, steel cut-out boxes, etc. The company is doing the electrical work for the entire show. It will be represented by Henry Newgard, Martin Newgard and Dr. A. S. Goss.

The North Shore Electric Company, Chicago, will utilize its space as a reception room and will also have on exhibition a glass-encased meter connected to a bank of lamps of various candlepower, it being the company's desire to endeavor to demonstrate that the central-station meter is a mechanical device which accurately records current used.

The exhibit of the Northern Electrical Manufacturing Company, Madison, Wis., will comprise novel Northern equipments. No effort will be made to include specimens of each of the many types of apparatus included in the Northern line, the exhibit showing the most recent practice and progress. A Northern Electric rock drill in the mining size No. 7 will be shown in actual operation, cutting rock. The principle of the Northern Electric rock drill is radically different from air-drill practice, heretofore developed. Were it not that electricity is the most economical agent for mining service, the drill might as well be driven by an air or steam motor. Power is transmitted from the electric motor to a revolving helve, in which are mounted two hammers fitting piston-tight and so placed that centrifugal force throws them outside the diameter of the helve. The hammers impinge on a simple steel device which serves both as piston and chuck of the drill steel. The hammers are cushioned on air. Suitable provision is made for turning the drill steel between blows. The device does not vibrate while in operation. It can be furnished for quarry or mine mounting and is readily disassembled for new settings. Suitable provision is made for forcing water into the drill holes when it is necessary to remove the rock cuttings in this manner. A Northern type S motor with Type B generator for load will be shown operating under far more severe conditions than prevail in the hardest shopwork. The novel feature of the Type S motor is that the field is laminated. The laminations are horseshoe-shaped, and the method of assembling makes each tip of the horseshoe half of the pole and forms an integral pole tip. An Atwood vacuum-claning outfit will be shown driven by a Northern Type B motor. The rock cuttings from the drilling operations will form a convenient load for the cleaner and demonstrate its ability to handle such material successfully. A Northern Type S grinder and Type S buffer will also be on view. The Type S design is embodied because of the ability of the machine to carry load and wide speed variation.

The Pacific Electric Heating Company, of Ontario, Cal., will be represented by H. F. Holland, manager of the Chicago branch, and he will have to assist him J. R. Richardson, W. L. Gender, Miss Lucy Blank, Miss Gladys Lee. The principal feature of this exhibit will be a new automatic cut-out iron. This iron is an entirely new departure. The automatic cut-out attachment is a mechanical device, pure and simple. It is built into the iron and so constructed that if the iron is left in circuit without being used, whenever the iron reaches a point above the working temperature, a spring is released, which throws the iron switch plug entirely off of the iron, and this plug may not again be inserted until the temperature has lowered enough to set the mechanism, when the spring will again engage. This operation will be indefinitely repeated, eliminating any possibility of the iron causing a fire. Besides these automatic cut-out irons, there will be exhibited the company's standard "Hot Point" iron, with three improvements. All the 1909 irons will be constructed with easily removable heating elements, and the back plate, attached to the heel of the irons and used as an iron stand, will be so constructed as to enclose the leading-in terminals. Large pressing and tailor irons in which the heat may be adjusted to three distinct temperatures, the "El Tosto" toaster, the electric curling-tong heater, and a full line of other devices, such as air heaters, foot-warmers, chafing-dishes, percolators, will be shown. As an attractive novelty one of the largest electric irons that has ever been manufactured will be in constant service during the entire show, and unique souvenirs will be distributed.

The Palm Engineering Company, Detroit, Mich., will show vacuum-cleaning machinery for all classes of buildings. The new features of this machinery, as compared with the old systems, are that the Palm system uses a pump especially designed for vacuum-cleaning purposes and especially designed to handle dust-laden air. This pump does away with the necessity of using any strainers in the form of bags, water separators, etc., maintains the efficiency of a reciprocating pump, and at the same time does away with the friction caused by tight-fitting piston rings in the ordinary type of vacuum pump. This is made possible by the use of the company's patented constant-flowing water packing, which enables the saving of practically fifty per cent of the power required to operate such a pump does away with the necessity of any attention to cylinder lubrication; and care as to the special kind of oil used which is generally necessary. The power required to produce suction is one-half horsepower.

The Peerless Light Company, Chicago, will exhibit a full line of art-glass shades for gas and electricity, portable gas and electric lamps, a new Peerless gas lamp and a new electric sign. William Herskovitz will have charge of the booth, with Robert Witz as his assistant. The others in attendance will be Leopold Landesman, Abraham Herskovitz, Max Herskovitz, J. G. Shonfarber, Arthur Davidson, Ben F. Henshel and Milton Zucker.

The exhibit of the Pelouze Electric Heater Company, Chicago, will consist of

its new "Universal" electric sadirons, and will be in direct charge of William Nelson Pelouze, president of the company, and Charles P. Madsen, vice-president and engineer, one of whom will be in attendance at all times. They will be assisted by lady demonstrators, who will demonstrate the irons under actual working conditions. The company will hold a practical endurance test. At the beginning of the show the current will be turned on an iron and left on day and night until the close of the show. The irons are made in three sizes—four, six-and-one-half and eight-and-one-half pounds, and heating elements of different temperatures and different voltages can be obtained for each size, which are interchangeable. These irons are entirely new on the market, being presented to the trade at this show for the first time. The most important mechanical advantages are claimed to be a better balanced iron, giving greater ease in handling; absence of stand; ability to control the temperature in a simple manner, greater efficiency and endurance, together with quick starting ability and a heating element which is a complete unit.

The Perfection Vacuum Cleaner Company, Chicago, will exhibit its "Perfection" vacuum cleaner and portable cleaners, for both direct and alternating current, capable of producing from fifteen to twenty inches of vacuum; also its installed type of machine, which is most simple in its construction, and capable of producing over twenty inches of vacuum when operated with a one-horsepower motor. Those who will be in attendance are: Harvey Wallace, president; O. E. Becker and J. L. Wallace.

The Pyro One Light Electric Sign Company, Chicago, will exhibit the Pyro electric sign. There will be in attendance the company's regular force of salesmen, its president and treasurer, S. Samson, and its secretary, C. Mueller.

The Red Cross Antiseptic Company, Chicago, will exhibit the "Red Cross" antiseptic telephone mouthpiece, which can be readily attached to any telephone, and is intended to prevent the inoculation of telephone users from contagious diseases, which recent investigations of eminent bacteriologists have proved are spread by the telephone. The device consists of a vulcanite mouthpiece, having an inner lining of perforated aluminum. This lining, at its interior periphery, is turned backward, so as to form a hollow rim, and a space is also left between the two materials of which the mouthpiece is constructed. The rim is filled with an absorbent material upon which, through a small hole in the outer edge of the rim, should be periodically dropped the Red Cross antiseptic fluid supplied by the company. The antiseptic gas thus generated circulates between the inner and outer parts of the mouthpiece and finds its way into the interior by means of the perforations in the lining. The representatives of the company at the electrical show will be: Lester D. Freed, Aaron Levitt, Lillian McGraw, Walter F. Parker and Mabel Queenen.

The Stolz Electrophone Company, Chicago, will show the Stolz "Electrophone," a sensitive portable telephone which enables deaf people to hear at close distance and also in public places; the Stolz opera "Electrophone," a more powerful device, similar to the above, having a microphone arrangement in a case similar to a small kodak, with a funnel-shaped concentrator which throws more sound against the transmitter, the apparatus being used where the small portable electrophone is not suitable; the Stolz church "Electrophone," a device permanently installed in churches, with the transmitter on the pulpit and wires running to different seats; the Stolz "Stenogrophone," used in dictation, and also for communication between different rooms.

The exhibit of the Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y., will consist chiefly of a telephone exhibit, showing the manufacturer's numerous types of generator call and central-energy instruments for various kinds of service. The two prominent displays of this exhibit will be mounted on the panels which form the background of the booths, one being devoted to the company's new line of central-energy intercommunicating telephone system, completely wired and in operation. The other panel will display a complete equipment of the company's selective-alarm railway-dispatching telephone system, including the dispatcher's office equipment and several local station equipments, with telephone instruments and semaphore signals connected. This exhibit will be completely wired and shown in operation for demonstrating purposes. Two hexagonal revolving display turrets will be located in the booths, upon which will be mounted various types of telephones, including on one turret all the generator-call telephones, and on the other the central-energy telephones. These displays will include telephones for such service as farmers' rural telephone lines, country and city exchange, office, business and residence type telephones, ironclad mine telephones, portable interurban-railway telephones, all steel telephones, microphones, etc. These telephones will be connected and wired so that they may be rung intermittently for attracting the attention of passing visitors. Several types of magneto and common-battery switchboards of the smaller types will be on exhibition, including the company's self-restoring gravity-drop magneto switchboard, and a lamp-line private-branch switchboard. A. M. Haubrich, Chicago manager, and the various Chicago office employes; H. C. Slemin, advertising manager, Rochester office; Ben C. Hyde, manager of the Kansas City branch, and, at different times, several representatives from the states surrounding Illinois, will be in attendance.

The Swedish-American Telephone Company, Chicago, will have quite an extensive display of magneto equipment, consisting of magneto switchboards, both of the floor-type cabinet and the desk-type cabinet, as well as the new style of desk-stand equipment and miscellaneous parts, and central-energy and magneto telephones of the wall and desk types. The exhibit will be looked after by W. O. Rhode, Fred Seeley and Messrs. E. B. and A. V. Overshiner.

The Swedish Electric Vibrator Company, Chicago, will exhibit and demonstrate a complete line of electric-light current and battery-operated massage vibrators. The electric-light current vibrator weighs only twenty-four ounces. The features of this vibrator are: It will operate equally well on either direct or alternating current, 110-120 volts, sixty cycles; there is practically no vibration in the handle; has brush-shifting device, so that the speed can be regulated; comes in a handsome portable case, including six different applicators, long, flexible, silk cord, with plug and socket attached. The battery vibrators also come in portable cases, including six cells of powerful electric batteries, and five different applicators. The company will also show a vibrating chair. Its booth will be taken care of by professional lady masseuses, who will give free demonstrations.

Taussig & Babcock, Chicago, who are exclusive agents for the Burke Electric Company, Erie, Pa.; Kerr Turbine Company, Wellsville, N. Y.; Condit Electrical Manufacturing Company, Boston, Mass.; American Instrument Company, Newark, N. J.; Automatic Switch Company, New York city, N. Y.; Patten Manufacturing Company, Chattanooga, Tenn., will exhibit a small Kerr turbine direct-connected to a five-kilowatt Burke generator, a switchboard on which will be mounted American instruments, Condit circuit-breakers and examples of the Automatic Switch Company's motor-controlling apparatus. They will also show a special generator designed for furnishing electric light and ignition on automobiles, and a friction clutch manufactured by the Warner Clutch Company. William S. Taussig and Fred R. Babcock, and P. R. Fisher, sales manager of the Condit company, will be in attendance.

The United Pump and Power Company, Chicago, will exhibit two complete installations of the Perry pneumatic water system, one installation consisting of one No. 14 Perry pneumatic pump having a delivering capacity of thirty to forty gallons per minute. This pump will be installed in an open tank, which will represent the well. One 300-gallon storage tank for air will have air supplied by a single-acting six-by-six-inch "Granite" compressor, driven by a three-horsepower Wagner electric motor. The motor will be started and stopped automatically by a Perry controller. This controller will operate a starting box, throwing the motor on in the same way as it would be started by hand. When the desired tank

pressure has been attained the motor will be stopped automatically with the same device. The other installation will consist of one No. 6 Perry pneumatic pump, having a delivering capacity of eight to ten gallons per minute, to be installed in a glass tank, so that its operation may be observed from the outside; one 100-gallon storage tank for air, the air being supplied by a double-cylinder Perry air compressor, driven by a one-half-horsepower Wagner electric motor. This motor will be started and stopped with an ordinary switch. This device will start and stop the motor in practically the same way as the larger motor, excepting that the contact will be direct, in place of in connection with a starting box. The Perry pneumatic pump has never been exhibited before at any public show. The controlling devices are absolutely new, as the patents have only recently been issued. Thomas O. Perry, the inventor of the Perry pneumatic pump, Perry controllers and Perry double-cylinder compressor, will be in attendance part of the time, as well as all of the officers of the company, and George C. Huppertz, manager of sales.

The Wagner Electric Manufacturing Company, of St. Louis, Mo., will exhibit a marble-panel switchboard on which is mounted one of each of the several types of instruments which the Wagner company manufactures. This will clearly show the wide and varied line of instruments offered by this company, comprising not only small round-pattern and large round-pattern instruments, but also horizontal edgewise, and vertical edgewise instruments, not overlooking large central-station types of instruments. The Wagner company will also show one of its latest types of polyphase induction motors, thus exhibiting some new and interesting features in polyphase-motor design and construction, and one of its latest types of well-known single-phase, alternating-current motors. The company will be represented by W. A. Layman, vice-president and general manager; W. Robbins, assistant general manager, and F. N. Jewett, sales manager, all from St. Louis; and by C. B. Richardson and C. C. Warner of the Chicago office.

The Westinghouse Electric and Manufacturing Company, Pittsburg, Pa., will have on exhibition a large line of apparatus, including several of its new shell-type distributing transformers, known as Type "S." These transformers have just been placed on the market, and are of the most approved design. The losses are remarkably low and the life particularly long, due to the superior grade of alloy steel and insulation used in the construction. The line includes transformers from one to fifty kilowatts capacity for fifty to 133 cycles. A small transformer is shown as a model, with the assembled coils. Several types of lightning arresters will also be on display, with circuit-breakers, wattmeters of several forms, ammeters and voltmeters. Of more general interest will be sadirons, not alone for general use in the household, but for laundries and tailors. The satisfaction which these irons are giving is well instanced by the fact that during the year in which these irons have been manufactured by the Westinghouse company not one has proved defective, the company guaranteeing to replace any iron giving trouble in one year's operation. Small telephone-booth fans and eight-inch bedroom fans will also be shown. Their speed may be adjusted for a considerable speed range to suit the requirements, and in any case the power to run one all day or all night is not over a cent or two. Luminous and non-luminous electric heating coils are also shown, this being the first time anything of the sort has been shown by the Westinghouse company; also an electrically heated glue-pot, a chocolate warmer for melting chocolate for confectionery, and several standard desk fans and two oscillating fans, as well as a new type of ceiling fan. In the line of motors, there will be shown a number of both direct-current and alternating-current motors of small capacity up to five horsepower. These include two sewing-machine motors with an attachment which fits any standard make of sewing machine, either stationary or drophead types; also a jeweler's buffing motor with shaft extensions on both ends. There are also small power motors, single-phase, of one-twentieth, one-twelfth, one-eighth, and one-fourth horsepower; also a new type of single-phase motor in larger capacities up to five horsepower; several polyphase induction motors of a standard line covering motors from one-half horsepower up to very large sizes, and a number of direct-current motors of the standard lines. Motor-starting devices will be shown prominently, as the Westinghouse company supplies rheostats of various types suitable for all its motors. Two battery-charging outfits and metallic flame and other types of arc lamps will come in for their share of attention. Westinghouse representatives in attendance will include T. P. Gaylord, manager, Chicago office; and E. M. Bischoff, J. W. Busch, H. H. Caughlin, Stephen Gardner, Ivan Hennings, W. B. McDonald, Malcon McNeil, A. L. Millard, A. M. Miller, R. H. Moore, S. G. Peticolas, W. R. Pinckard, C. W. Regester, R. E. Schaulin, J. M. Schilling, Charles Talbott, all of the Chicago office of the Westinghouse Electric and Manufacturing Company; C. B. Humphrey, manager, Detail and Supply Department, and J. W. Lewis and G. B. Griffin, of the department; S. L. Nicholson, manager Industrial and Power Department; C. S. Cook, manager Railway and Lighting Department; J. C. McQuiston, manager Westinghouse Companies' Publishing Department; C. C. Chappelle, manager Westinghouse Machine Company, Chicago.

The following manufacturers will also make extensive exhibits. The location of the booths will be in conformity with the diagram on page 129: Crane Company, Federal Electric Company, Shelton Electric Company, Western Insulation Company, Kellogg Switchboard and Supply Company, Telephony Publishing Company, Manhattan Electrical Supply Company, *Electrical World, Electrical Record,* ELECTRICAL REVIEW AND WESTERN ELECTRICIAN, Robbins & Meyers, Appleton Electric Company, Commercial Appliance Company, Electric City Publishing Company, American Steel and Wire Company, National Acme Manufacturing Company, Popular Electricity Publishing Company, Jewell Electrical Instrument Company, Roth Bros. Company, Simplex Electric Heating Company, Western Electric Company, Electric Cleaner Company, C. S. Neville, Monarch Vibrator Company, Thomas Graham, Mechanical and Electrical Manufacturing Company, Phœnix Glass Company, American Automatic Advertising Company, Electrical Testing Laboratories, Cyclone Vacuum Cleaner Company, Murphy Electricity Rectifier Company, Electrocraft Publishing Company, The Caloric Company, National Carbon Company.

Is Erection of Steel Poles Structural Iron Work?

With the erection of 300 steel poles for the transmission line of the Sanitary District of Chicago along the new Wilmette channel of the north shore drainage canal, the structural-iron workers' union has taken issue with the electrical workers on the matter of jurisdiction of the work. As the poles are of steel construction the iron workers contend that they should be given charge of their erection, while the electrical men claim as much right to perform this work as the erection of any wood or other poles. As a result of the conflict work on the line was tied up for several days.

The transmission line is being built to supply a pumping station which will be located at the lake shore and the extreme terminus of the channel, lifting water from the lake several feet into the drainage channel which flows into the drainage canal. As the power for pumping is derived from the Sanitary District's hydroelectric plant at Lockport, Ill., using the thirty-eight-foot fall of the drainage canal into the Desplaines River, the pumping station at Wilmette can virtually be said to furnish part of its own power.

New York Electrical Society.

The next meeting of the New York Electrical Society will be held in the Engineering Societies' Building, 39 West Thirty-ninth Street, New York city, on Wednesday evening, January 20. Dr. John F. Kelly will deliver a lecture on the development of the electric piano player.

REVIEWS OF CURRENT ENGINEERING AND SCIENTIFIC LITERATURE

SAFETY ARRANGEMENT AGAINST OVERLOAD FOR MINE-HOISTING AND SIMILAR MACHINES.

In current practice electric hoisting machines are provided with automatic interrupters in order to prevent their being damaged by currents of abnormal intensity. This interrupter may itself become a source of danger, for, after it operates, the machine tends to revolve in the opposite direction, on account of the weight applied to the drum, and this may mean a catastrophe to material or persons, if the attendant does not immediately apply the brakes. The object of the arrangement diagrammatically shown herewith is to permit the attendant to stop the machine by means of the operating lever after the automatic interrupter has acted. *a* is the generator, *b* the hoisting motor, *c* the automatic interrupter, and *d* a resistance in shunt with the main contact and in series with the coil actuating the interrupter. When the interrupter breaks the main circuit, the generator still partially feeds the motor through resistance *d*. As the value of the resistance may be determined arbitrarily while the automatic interrupter retains its full effectiveness and the current strength is still sufficient to permit the attendant to stop the machine. The resistance also has the advantage of decreasing the shock which results from a sudden breaking of the circuit. The arrangement forms the subject of a patent application by the Felten & Guilleaume-Lahmeyerwerke, of Frankfort-on-the-Main, who are introducing it.—*Translated and abstracted from L'Electricien (Paris), December 19, 1908.*

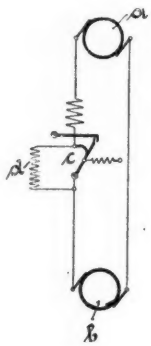


DIAGRAM OF SAFETY ARRANGEMENT.

A NORWEGIAN HYDROELECTRIC POWER SCHEME.

One of the latest chemical processes to be adopted on a commercial scale is that in which nitrogen is extracted from the air and fixed in manure. The manufacture was first started on an experimental scale in Italy, but the successful results obtained by agricultural experts aroused so keen a demand for this product, calcium cyanamide, that large works were erected in Odda, at the head of the Hardanger Fjord, in Norway, capable of producing 12,000 tons a year. In conjunction with this factory, a second works was erected to supply the necessary carbide required as the raw material of the manure, and for the independent supply of carbide for lighting purposes. The present plant has a capacity of 20,000 horsepower. A long pipe line stretches down the side of the hills. The water supply is taken from a chain of lakes lying in the Tysse Valley, which are fed by several large falls deriving their water from permanent glaciers. The total head at the turbines is about 400 metres. There are eight 3,000-horsepower, 11,000-volt generators, direct-coupled to Escher-Wyss turbines. The turbines are fitted with the usual governing gear, and also with a safety device close by the intake, so that if there is a sudden rush of water or a considerable rise in pressure, the bursting of the safety pipe allows a direct overflow to the outfall. Excitation is obtained from two small direct-current sets, each of 120 kilowatts capacity at 100 volts. Lattice girder poles are used on long spans, and ordinary wooden poles for short spans on the transmission line. The plant is operated by the cyanamide works of the Northwestern Cyanamide Company, Limited. There are also two substations, one for the motor, and the other for the furnace supply. The motor substation contains high-tension and low-tension switch gear, and standard 600-kilowatt, oil-insulated, water-cooled transformers. The furnace-room substation is equipped with high-tension switch gear and transformers, transforming from 11,000 volts to the low pressure required for the electric furnace. The carbide is conveyed by an aerial ropeway to the cyanamide works, where it is crushed in a series of three special mills to a fine powder. It is then filled into movable retorts, which are placed in the electric furnace and heated to 1,000 degrees centigrade, nitrogen being forced in under pressure. As the result of continuous heating for several hours, cyanamide of lime is formed. This, after cooling, is conveyed to crushers, which reduce it to a fine powder. It is then stored in the silos ready for packing and delivery to customers as a twenty-per cent nitrogenous fertilizer.—*Abstracted from the Electrical Review (London), December 25.*

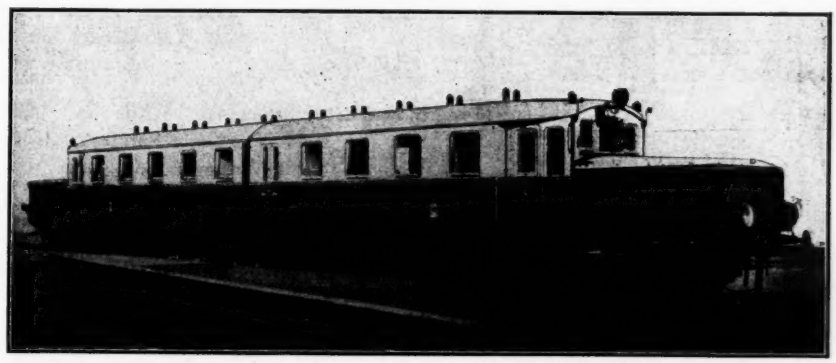
THE DEVELOPMENT OF THE SMALL STEAM TURBINE.

Charles A. Howard, in a second paper on this subject, states that the great extension in the use of the turbine for commercial purposes in sizes under 300 horsepower extends back but a few years, so that it has scarcely begun to open up its unquestionably broad field. In the early days the promoters of small turbines picked as the place to start the equipment of auxiliaries of steam power plants with prime movers. They have been installed in large numbers for driving exciters, centrifugal boiler-feed pumps, centrifugal hot-well pumps for condensers, fans for forced and induced draft, and in many cases in small plants for driving the main generators themselves. For steam-driven exciters the steam turbine is the ideal type of prime mover. As in most power plants there should be at least one steam-driven exciter, there is a place in nearly every plant for at least one small steam turbine. Speed regulation within one-and-one-half to two per cent is easily attainable, and this is as close as is necessary or desirable for the exciter. The use of multi-stage centrifugal pumps for boiler-feeding purposes is only of comparatively recent date, but the great success of all those which have been installed points to a large increase in their use in the immediate future. On account of the high heads against which these pumps are run, their speed is far above the maximum limit of a reciprocating engine, so that it is only a question of a steam turbine or an electric motor. In connection with con-

denser installations, there is a very large field for the turbine, especially when the condensers are of large sizes, and separate wet and dry air pumps are used. Condensers using turbine-driven centrifugal circulating pumps are now being built, and show a large saving in the space taken by the condensing machinery. At the present time there is no commercially successful dry vacuum pump in use, but everything points to a special development of this apparatus at an early day. This machine, if successful, will call for a steam turbine for its motive power. Fans have recently been developed which run at a higher efficiency at a comparatively high speed than the larger fans can do at their slow rotative speed. The maintenance of engines driving forced-draft fans can be made almost to disappear by the substitution of the turbine. In small waterworks, where the choice is between the centrifugal pump and the low-duty, compound, duplex pump, the former can at least hold its own in initial cost, and will in all probability be cheaper for a given capacity. Another very promising field for future development in which little has been done as yet is the ventilation of mines. The present practice in this branch of engineering is to install at a mine one or more fans having wheels or runners from six to thirty-five feet in diameter, and running at very slow speed, generally driven by either one or two Corliss engines, one on one side of the fan, and one on the other. These units are very expensive in first cost, much more so than fans used for other purposes, and their running expenses, while comparatively low, are still considerably in excess of those of a turbine-driven unit. About the only possible accidents which can happen to a turbine are derangement of the governor and breaking of the shaft, and both of these are equally liable to happen to a reciprocating engine. Another line in which similar work has been done before, which offers extensive opportunities for the turbine in the future, is the driving of generators for steam-railroad train lighting. In marine work but little has been done with small turbines; in fact, it is only for a few years that the large turbines have been used to any extent on shipboard. One of the most popular uses of the turbine up to the present date is for driving blowers for gas works and foundry cupolas. They must be started quickly, and the turbine does not have to be warmed up. If water is carried into it by the steam, it merely slows the turbine down a little; whereas, with a reciprocating engine it would knock out the cylinder head. Blowers direct-connected to turbines running from 2,500 to 3,500 revolutions per minute can be brought from a standing start to full speed in from seven to ten seconds. For small isolated electric power plants, the small turbines are pressing the best of the reciprocating engines very hard for first place.—*Abstracted from the Engineering Magazine (New York), January.*

ACCUMULATOR RAILWAY CARS OF THE PRUSSIAN STATE RAILWAYS.

The Prussian State Railways have now put into service new accumulator double cars, which, in addition to the large through trains, are to be used for making intermediate connections on their main and branch lines, where there is a heavy traffic. The first official run of the double cars, which were supplied by Feiten & Guilleaume - Lahmeyerwerke, Frankfort-on-the-Main, took place on a twenty-seven-mile stretch between Mayence and Gaualgesheim-Münster. Not only was the normal speed desired reached, but on certain parts of the track this was exceeded. The braking tests also gave satisfactory results. Among the features of particular interest in the equipment is the brake handle, which, on being released, automatically switches off the current and brings an emergency brake into immediate action. In order to start the motor the driver must press down the handle, which, under normal conditions, is pressed upward by a spring. This operation closes two contacts, which in turn close a main-circuit automatic circuit-breaker. One of the two contacts remains rigidly connected with the controller, while the other is only connected with it when the driver presses down the handle. Should the driver release his hold upon the controller handle while it is in either a running or braking position, it immediately flies up, disconnecting the movable contact, which returns to its off position by means of a spring. By this means the main circuit is interrupted, and an electrically operated valve on the compressed-air brake is opened. The weight of the driver's hand is sufficient to hold the handle down, and is not so tiring as with a push-button release. On starting up, the motors are both in series, and both in parallel when running on an open stretch. A reversing switch, by means of which the train may be run either forward or backward, is fitted in the driver's cab. By reversing the direction of rotation of the motors, the headlights on the train at the same time are automatically reversed. On the trial run it was found that the train, when traveling at a speed of thirty-six miles per hour, could be brought to rest, when using the compressed-air brake alone, in 600 feet; when using both compressed-air and electrical brakes, in 300 feet. The cars are also fitted with a small mechanical brake, which may be operated from each driver's cab by means of a hand-wheel. The electrical equipment of each complete train consists of two interpole series motors of the totally-enclosed, water-tight type, each giving fifty horsepower on the two-hour rating, or eighty-five horsepower on a one-hour rating. They are fitted on the one side with the reduction gear on the shaft, and on the other side suspended by means of springs to the under side of the frame. The battery consists of 168 cells, fitted in two compartments, eighty-four in each, in front of the driver's cab. The total pressure is 310 volts, and the capacity 368 ampere-hours on a one-hour rating. The distance of sixty-two miles may be run on one charge, and a maximum speed of thirty-one miles can be attained on the level.—*Abstracted from the Electrician (London), December 25.*



GENERAL VIEW OF AN ACCUMULATOR DOUBLE-CAR ON THE PRUSSIAN STATE RAILWAYS.

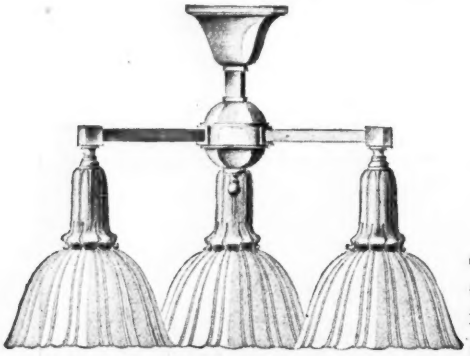
INDUSTRIAL SECTION

ILLUSTRATED DESCRIPTIONS OF NEW AND STANDARD ELECTRICAL AND MECHANICAL APPARATUS

"Opalux" Tungsten Reflectors and Fixtures.

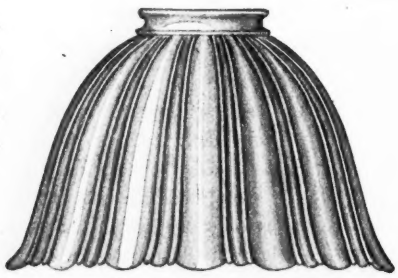
The increase in the use of tungsten lamps has been so rapid that the question of economy in the distribution of the quantity of light furnished by these lamps has not received the attention it deserves from those who are selling or using these high-efficiency units.

The use of tungsten lamps presents a new problem in electric lighting—that of securing a proper diffusion of the intense rays which are developed.



"OPALUX" TUNGSTEN FIXTURE.

One of the methods offered to secure better results with the new lamp is a glass reflector with a patented inner and outer surface, in which science and art have been combined to produce an ideal system of diffusion when used with these lamps.

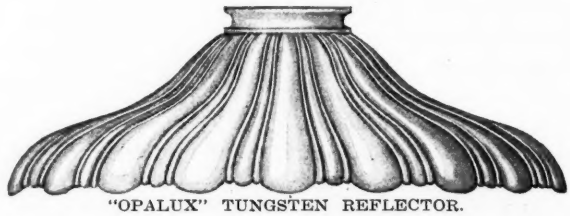


"OPALUX" REFLECTOR, FOR USE WITH 60-WATT TUNGSTEN LAMP.

The ordinary globe or shade will frequently absorb from one-third to one-half of the light given out, which means the loss of one-third to one-half the cost of current.

The extremely desirable feature of perfect ray diffusion secured with this reflector is, however, only one of the many veloped in reflectors. Other essential attributes of Opalux reflectors are their artistic appearance, mechanical stability, ease of cleaning, minimum liability to become soiled and minimum limit of cost.

In the Opalux reflector the diffusing surface is on the reflecting side. The reflector is a glass which is perceptibly translucent, but has a patented surface which is entirely different from that produced by the ordinary etching, sand blasting or enameling processes. While the "glaze" of the glass is entirely removed, the surface is really so smooth that it can be cleaned as readily as ordinary glass. At the same time it does not give sufficient direct reflection to produce perceptible glare.



"OPALUX" TUNGSTEN REFLECTOR.

The reflected light from this glass is of a pearly luster, slightly opalescent. The transmitted light shows a variation of soft color tints and illuminates the ceiling with a warm glow, entirely free from sharp contrasts in intensity. The ornamental detail has been designed to present no sharp corners or deep grooves, but an even surface very readily cleaned.

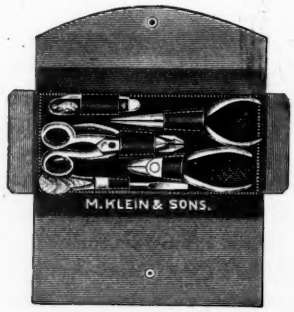
The curve resulting from a perfectly diffusing surface would be independent of the contour of the surface, and the more the reflection partakes of the regular or specular nature and the less of the diffusing nature the more the distribution curve is influenced by the shape of the reflecting surface. Since in this glass the reflection is largely diffused the contour of the reflector is varied to several forms without materially changing the distribution curve. Being made by pressing, the reflectors have ample mechanical strength.

The mistake has been made so frequently of considering the globes and shades entirely distinct and separable parts of the fixture that special fixtures have also been designed for use with Opalux reflectors to show that harmony and proportion of line in both fixtures and glassware are important elements in the decorative treatment of lighting fixtures. These fixtures are simple in design and are intended to anticipate a demand for high-grade tungsten fixtures which will be artistic, attractive and durable and at the same time harmonize with any style of decoration used in buildings where tungsten lamps will prove serviceable. The accompanying illustrations show the flat and bowl type of Opalux reflectors together with a vew of one of the styles of ceiling fixtures.

The reflectors and fixtures are being marketed by the Pettingell-Andrews Company of Boston and the Central Electric Company of Chicago.

Klein's Electrician's Pocket Tool-Kit.

The accompanying illustration shows a new electrician's pocket tool-kit, placed on the market by M. Klein & Sons, 81



ELECTRICIAN'S POCKET TOOL KIT.

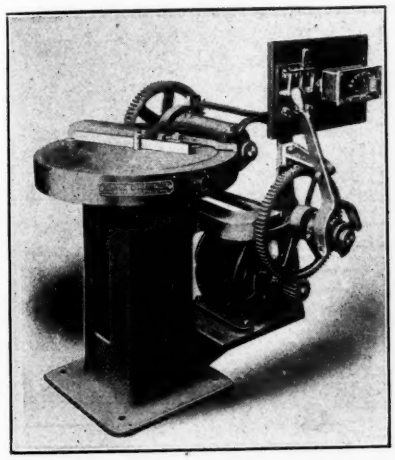
West Van Buren Street, Chicago. This tool-kit contains a selection of Klein tools such as have been found particularly desirable by electricians and wiremen on switchboard and telephone work. It is of convenient pocketbook style, with firm metallic clasp and measures four by nine inches. It contains the following tools: One single-blade electrican's knife, one

five-inch Klein side-cutting pliers, one five-inch Klein oblique plier, one six-inch Klein long-nose side-cutting plier, one three-and-one-half-inch blade screwdriver and one pair five-inch N. P. electrician's scissors. The pliers can be furnished in plain black finish or nickel-plated.

A New Machine for Bending Tests.

The Olsen special testing machine shown in the accompanying illustration is designed for the "cold-bend" testing of iron and steel specimens. The "cold-bend" test is today specified by a great many manufacturers for a great deal of iron and steel, and the use of this machine greatly facilitates the process.

By the method heretofore used, bending tools were inserted in an ordinary tension-testing machine. This required considerable time for setting the machine which could be more profitably used for tension testing alone.



NEW MACHINE FOR BENDING TEST.

With this machine it requires only three minutes to bend a specimen double, that is, 180 degrees around a pin. The saving of time by the use of this machine for this special purpose in place of the old type of machine is of great advantage to a steel mill or other establishment, where a great many tests must be made in a short time.

The machine is intended for making a "cold-bend" test on iron or steel specimens up to a size of one inch square or equivalent. The specimen is bent around a pin of a diameter equal to the specimen's thickness. Any size of pin up to two inches in diameter may be used, the smaller sizes being reinforced to withstand the bending pressure. The pins have taper shanks so that they can readily be changed to suit the different sizes of specimens. In order to insure ready release from the taper fit, a knockout pin is provided, which, when tapped with a hammer, releases the bending pin. Provision is made for placing the bending pin at varying distances from the center as required. A taper liner at the back of the specimen serves for the adjustment of the various sizes of specimens to be tested.

The outer circular edge of the machine is graduated for every five degrees so that the specimen may be bent to any desired angle up to a complete bend of 180 degrees.

A small Westinghouse electric motor is mounted on a bracket at the rear of the outfit so that the entire unit may be located wherever desired to give the greatest convenience of access. The motor is known as a type "R," direct current, one-and-one-quarter horsepower, and runs at 1,250 revolutions per minute, furnishing ample power to bend the largest specimens used in the machine. The motor is controlled by a switch and starting rheostat, which are mounted just above the handle of a clutch on the first gear-reduction shaft. From this lever the operation of the machine is controlled by hand. To prevent damage to the outfit an automatic stop is provided which will mechanically throw out the motor switch at the end of the return stroke if the attendant should forget to operate the hand lever. The reverse motion of the table is obtained by reversing the motor by a double-throw switch.

The machine is manufactured and sold by Tinius Olsen & Co. of Philadelphia.

The Packard Electric Company.

The Packard Electric Company, of Warren, Ohio, has recently completed a new substantial brick building, comprising a basement and two stories, an addition which was necessitated by the natural growth of the business. A portion of the much-needed floor space is utilized for offices. The transformer department also has a new home in this building, and a portion of the insulating materials are handled in the second story. This new building, together with several old ones in the rear, makes a very complete little plant. Due attention has been given to possibility of further needs, in the recent purchase of an adjoining tract of land. This company manufactures the Packard transformers, which have been on the market since pioneer days, so that ripe experience in transformer requirements is a valuable asset of the concern. It is building a thoroughly up-to-date high-grade apparatus, using the most expensive grade of silico-vanadium-alloy steel, which has within the past two years revolutionized transformer design. The company was one of the first to recognize the qualities of this new material and to incorporate it in the transformer product.

The Packard company has also recently made valuable and important improvements in its cloth-manufacturing department. It has designed and built in its own factory new and expensive apparatus, and it believes that no other plant is equipped with machinery of a like nature. N. A. Wolcott, manager of the company, is the designer of this new apparatus by which the output has been increased more than tenfold. The company is, therefore, not only enabled to handle the increased demand very satisfactorily, but by the new process an even higher quality than before is actually realized.

PACKARD ELECTRIC COMPANY'S NEW PLANT.

Cambric bias-cut tape is another specialty which is developing favor very rapidly. It is necessary to use material of this character, in place of tape saturated with a rubber compound, for all high-voltage work.

The manufacture of insulating varnishes is receiving more attention than ever before. The company's manufacturing capacity is sufficient to enable it to offer a limited line of varnishes to the trade. These materials are meeting with ready favor, and this portion of the business promises shortly to become one of the strongest departments.

Ignition cable is another strong specialty line of the Packard company. This material has been on the market for the past eight years and has made a reputation for itself.

Additions to the Trumbull Company's Lines.

The Trumbull Electric Manufacturing Company, Plainville, Conn., advises that, beginning about February 1, it is to carry in stock a large supply of its regular type ES and PS panels, ready for immediate shipment, this stock to cover straight panels of these two types for six to twenty circuits. The company's service on regular panels not carried in stock has been brought to the highest point of efficiency.

A set of steel templates, 704 in number, has recently been completed for use in drilling each individual panel of the E, ES and P, PS types, illustrated in the catalogue. Thus no time is consumed in laying out the boards by hand. A full line of panel slate, already enameled, and a complete stock of panel circuits, assembled for mounting, and with bus-bars already finished, will insure the purchaser as rapid service in the case of all panel material as with switches.

With this new service there is no delay incidental to the usual method of laying out the boards by hand, as the orders go at once to the factory, and the necessary slate, already polished and enameled, is placed without delay under the proper template and drilled in a short time. The circuits, which are already assembled, require only a few hours to be mounted on the board. The Trumbull company believes that, so far as it knows, this service is unique in the country, and declares that by it all ordinary orders can be filled in from two to three days.

In addition, the Trumbull company carries a complete line of templates which are used for drilling the fastening holes in iron boxes, one template for each E, ES, P and PS panel listed in the catalogue.

By the aid of this new equipment, not only can all orders be rushed through in record time, but with absolute certainty of correctness, and without hold-ups, due to mistakes or delays in laying out and marking.

A Useful Combination Power Plant.

A small power combination outfit which, in two hours and at an expenditure of twenty cents, is estimated to perform the variety of heavy and particular labor about an average household, or shop, brings to the isolated residence or factory practically all the conveniences secured to the most favored community. Besides furnishing electric power for lighting and charging automobile storage batteries, the combination plant to be described is arranged with a vacuum-cleaning system to clean the house and the horses, besides developing extra power to run an ice-cream freezer, washing machine, fodder-cutter, wood saw or other shop tools, and to pump the family water supply.

The complete outfit to perform this multiplicity of useful functions consists of the following apparatus:

Ten-horsepower, four-cycle, two-cylinder combustion engine, equipped with muffler.

Westinghouse fifty-five-volt generator, capable of supplying forty eight-candle-power lamps.

Slate switchboard, twelve inches by five feet four inches, equipped with one twenty-five-ampere circuit-breaker, knife-switch, voltmeter, reading to seventy-two volts, rheostat mounting, ground detector outfit, relay, etc.

Vacuum pump, complete with grease cups, oil cups, piping for water and exhaust, etc.

Twenty-seven cells of storage battery, designed to furnish eight eight-candle-power lamps for five hours. Sand trays.

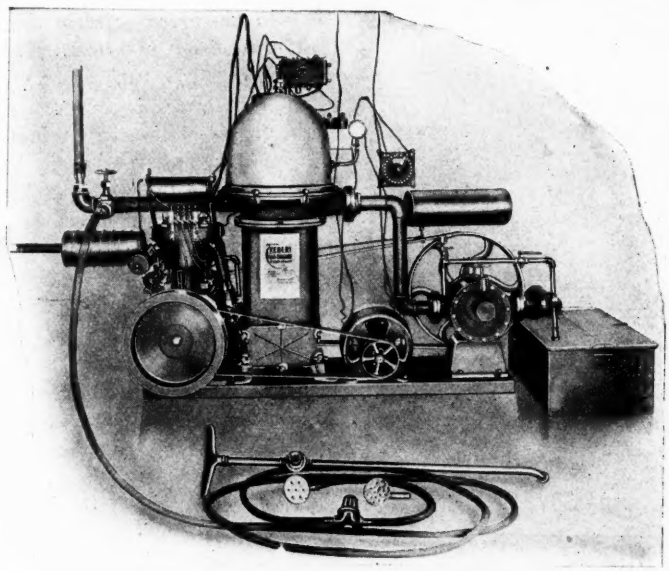
Dust collector, with piping, pressure gauge and globe and check valves.

Water tank, vacuum tools, wire, belts, etc.

The apparatus described is the combination plant No. 1 of the Trebert Gas Engine Company, Rochester, N. Y., maker of gas engines for automobile and marine purposes, motor-boat propellers, shafting, vacuum cleaning outfits and home and farm power plants.

Electrolytic Work in the Paper Industry.

Electricity has long been used as motive power for driving the machinery of paper mills, but its use as an electrolytic agent in this industry is quite new. An important contract for electrical machinery for this purpose has just been closed by the Oxford Paper Company, of Rumford Falls, Me., with the Western Electric Company. The machinery purchased includes five motor-generator sets, consisting of five 500-horsepower, 2,300-volt induction motors, driving 330-kilowatt, 230-volt, direct-current generators, with motor-driven exciters and a thirteen-panel switchboard. Power is to be taken from the line of the Rumford Falls Power Company, which is increasing its plant for that purpose. Everything is of the most modern type and designed to include the latest improvements in apparatus of its class.

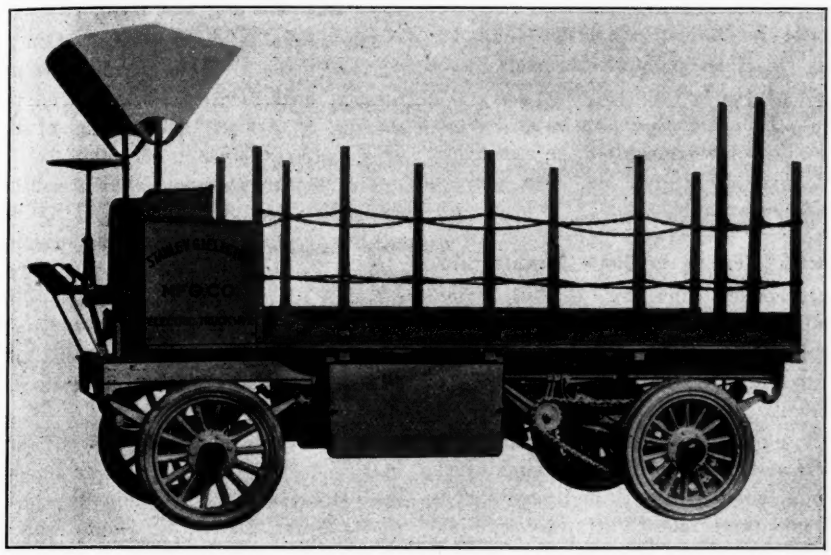


A USEFUL COMBINATION POWER PLANT.

This electrical machinery is to be used in a large new plant, which the Oxford Paper Company is now building at its Rumford Falls mills to manufacture, for its own use, bleach liquor and caustic soda by a new electrolytic process invented by Jasper Whiting, of Boston, and developed under his direction during the past three years to a point where it is said to have obtained a high degree of efficiency. The Whiting process, unlike those previously used for manufacturing the above chemicals, employs mercury as an agent and produces only chemically pure materials. It is said to be exceptionally economical as regards the use of power and to require only a minimum amount of labor in its operation.

The General Vehicle Company's Motor-Truck.

One of the most interesting sections of the recent automobile exhibition held at Madison Square Garden in New York city, was that of the General Vehicle Company, of New York. This company is the successor to the Vehicle Equipment Company, the pioneer in the commercial-automobile field, and the builder of a large percentage of electric power vehicles now in commercial service. A space seventy-six feet in the basement was filled with five of the seven sizes manufactured by this company, the smallest being a light electric delivery runabout with closed body, having a capacity of 350 pounds load, a speed of fourteen miles per hour and a mileage of fifty miles travel on one charge of the battery. Standard models of electric delivery wagons of 1,000 and 2,000 pounds capacity were shown complete and ready for work. These have a radius of action of forty miles, one charge, and ten and eleven miles per hour speed. A heavy trucking wagon of three-and-one-half tons capacity with stake body was also shown. This model has a mileage of thirty-five miles and a speed of seven miles per hour. A representative chassis of two tons capacity was also shown, which illustrated the general design of all models of the power-plant construction, the two-ton size having a radius of forty miles travel at eight-and-one-half miles per hour. In addition to the models exhibited, the company also makes a five-ton truck.

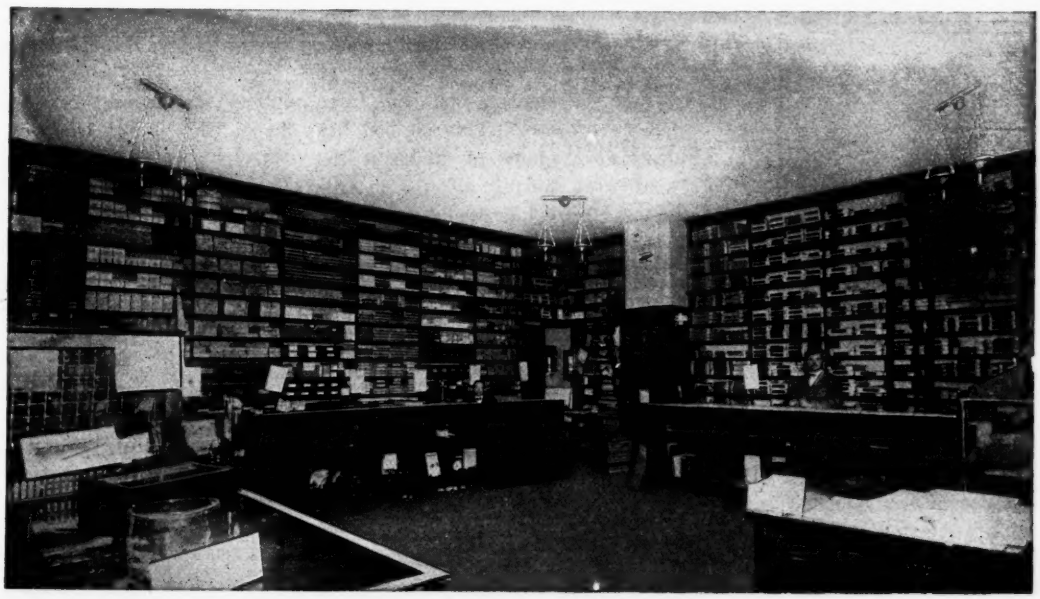


GENERAL VEHICLE COMPANY'S MOTOR TRUCK.

This company has a modern factory at Long Island City and is building practically all of the electric trucks and delivery wagons used in New York city. Its power vehicles are also in use in a majority of the large cities of the United States.

The "I-Comfort" System of Illumination.

Several hundred installations of the "I-Comfort" system of illumination worked out by the National X-Ray Reflector Company, Chicago, Ill., are now in use, and it is said that the results in every instance are very satisfactory. There is naturally some loss of light in this operation of indirect lighting, caused by the absorption by the ceiling. However, in indirect illumination one does not require the same foot-candles as with direct illumination. The iris of the eye naturally adjusts itself to the brightest object it has to encounter, which is the filament of the lamp. Where the source of light is within range of vision, as would ordinarily be the case with direct lighting, with indirect lighting the source of light is concealed and the pupil of the eye is allowed to dilate and take in more illumination and with greater ease and comfort. The eye can be applied without danger of fatigue or strain to the most trying work, such as reading fine print,



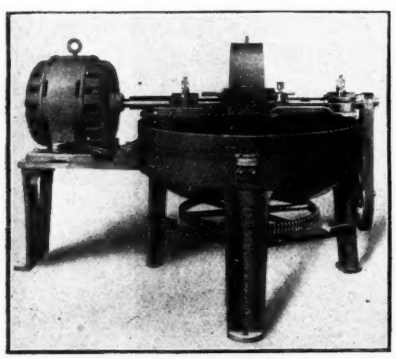
HARTZELL & LORD'S STATIONERY STORE ILLUMINATED BY "I-COMFORT" SYSTEM.

drafting or needlework, and the general effect of light produced is remarkably cheerful and restful. The accompanying illustration shows an installation made for Hartzell & Lord, stationers, LaSalle Street, Chicago, who give the following testimonial regarding the installation:

"Regarding the satisfaction the four 'I-Comfort' chandeliers installed in our store are giving, we beg to say that we have recently installed sixteen forty-watt tungsten direct lights, which were replaced by your system, and while we are obtaining fully as much light as formerly, the same is now evenly distributed, and the absence of any glare is very noticeable. We might also add that the wear and tear on the eyes (such as headaches) has been remedied altogether, and we cannot speak too highly of your invention."

Largest Meat Cutter in the World.

It is interesting to note that a meat cutter, which is claimed to be the largest ever made, has been recently changed from steam equipment to direct-connected motor drive, because of the delays formerly experienced in getting up steam, which materially reduced the output of the grinder. The meat cutter in question was built by the John E. Smith's Sons Company, of Buffalo, and is installed at the sausage factory of Jacob Moschel, also



ELECTRICALLY-DRIVEN MEAT CUTTER.

of Buffalo. It has a forty-three-inch bowl and six knives, each of which has a cutting edge eighteen inches long. The power is supplied by a Westinghouse three-phase type "CCL" motor of twenty-horse-power capacity, which runs at a speed of 1,420 revolutions per minute. Power is obtained from the circuits of the Niagara Falls Power Company.

Mr. Moschel began his sausage business but a few years ago, and it has grown so rapidly that now he cuts approximately 25,000 pounds of sausage a day. This cutter can handle the entire output if desired, as it has a capacity of 250 pounds in five minutes.

One of the main reasons for the change from steam to motor drive was the saving in the expense for attendance of an engineer, as well as the greater convenience when motor driven. The direct connection of the motor to the cutter eliminates belts, shafting, pulleys, etc., and effects a substantial saving in wear and tear. The attendant of the meat cutter does all the work of looking after the machinery that formerly required the entire time of another man.

Electric Heating in Cloth Manufacture.

One of the chief parts in cloth manufacture, says the *Electrotechnische Zeitschrift,* December 17, is the finishing process by which the material is improved and given its fine appearance. The entire finishing process is again divided into several parts, and among them the pressing, which makes the cloth smooth and glossy, plays an important role. The pressing is accomplished by folding the cloth, placing between each layer a press board of smooth wood about one millimetre thick and putting the bale of cloth so prepared under a press, where the hardwood under each layer produces the gloss. The fibres of the textile are rendered more pliable by the simultaneous application of heat, and the generally employed method is to heat the press boards in special steam chests and place them between the layers of cloth, where they remain for about three hours under pressure. This method has several drawbacks, one of which is the impossibility of making all the boards equally hot, the result being an uneven finish. The process, moreover, requires a great deal of time. These disadvantages are overcome by the new method of Julius Sarfert, who has invented an electrically heated press board. These boards are one to one-and-one-half millimetres thick and are used in the same manner as ordinary ones, except that they are required only at intervals of three to four centimetres, that is, at about every fortieth layer, the common boards being used otherwise. At each side of the press is a copper bar, which supplies the current for heating. The strength and tension of the current varies, of course, according to the size of the press board and the time in which it is desired to bring the same to a certain degree of heat. The possibility of controlling the heat is also of great advantage. It is stated that, although the cost of heating by electricity is somewhat higher than by steam, a great saving is effected in time and labor, two girls being able to treat almost three times as much cloth under the new method as two men could under the old.

Illuminating Engineering Society—Annual Meeting and Banquet.

The annual meeting and election of officers of the Illuminating Engineering Society, held in New York city on the evening of January 8, was one of the most successful since its inception.

This society does not follow the usual custom of electing its officers at the annual convention, but an annual meeting is held in January of each year, being preceded by a banquet. As the meeting was held in the rooms of the Machinery Club, it may be taken for granted that the desires of the inner man were well cared for.

There were some seventy-five members in attendance, including a large number from Boston and Philadelphia. Reports of the treasurer, Dr. A. H. Elliott, and of the chairman of the finance committee, L. B. Marks, show that the society has a surplus of over two thousand dollars.

The retiring president, Dr. Louis Bell, spoke briefly of the work during the past year and then introduced his successor, W. H. Gartley, of Philadelphia. Mr. Gartley is the first representative of the gas interests to be elected president of the society, and the selection was a happy one, and augurs well for an increasing interest in the subject by that fraternity. In addition to Mr. Gartley, the following officers were elected: Vice-presidents—C. O. Bond, Philadelphia; J. S. Codman, Boston; J. F. Gilchrist, Chicago.

Directors—A. S. McAlester, New York; E. N. Wrightington, Boston, G. R. Green, Philadelphia; J. R. Keech, Chicago.

Secretary—P. S. Millar, of New York.

During the informal discussion which followed the election announcements the subjects of the advisability of dividing the membership into active and associate classes and also as to the qualifications necessary for membership, received attention. A motion presented by Prof. E. L. Elliott, and seconded by H. Thurston Owens, instructing the president to appoint a committee to investigate and report at the next annual meeting was formally carried.

It was suggested that Thomas A. Edison, Prof. Elihu Thomson and Dr. Auer Von Welsbach be elected honorary members, but no definite action was taken.

O.

Current Electrical News

CONTINENTAL EUROPE.

(Special Correspondence.)

PARIS, JANUARY 2.—In the Pyrenees region of France there is to be installed a system of electric-traction lines to cover an extensive region. The lines are to be constructed by the Southern Railroad Company, which was granted the rights for this purpose not long ago. According to the present plans, there are to be installed three different lines of railroad, two of these being standard-gauge lines. One will run between Auch and Lannemezan, and the second from Arreau to Saint Lary. The third line is to be a narrow-gauge road between Castelneau and Tarbes. It is proposed to use hydroelectric power for operating all these lines, a turbine station being erected in the valley of the Oule.

A recent decree issued in France by the Minister of Public Works, Posts and Telegraphs provides for the nomination of a commission to draw up instructions for first aid in case of electrical accidents. The commission consists of twelve members who have been chosen from among the leading physicians and electrical engineers of Paris.

At Graville, France, there is soon to be erected an electric plant, which will be used as the center of a power-distribution system. It will be under the control of a syndicate which has been formed by the French Westinghouse Company in connection with a number of local companies. The new plant will be operated by steam turbines, according to the present project. Part of the current will be used in the factories of the Westinghouse company, which are located in this locality.

One of the most recent electric-tramway projects in Austria is the construction of a narrow-gauge road, which will run from the town of Czernowitz to the suburbs, with its terminus at the locality of Sadagora. In Hungary the government has lately granted the rights for a local electric line, which will run from Hölak, a station on the state railroads, to the watering place of Trencsenteplicz. It will be a single-track line with fifteen per cent maximum grades and fifty-metre minimum curves. The estimated cost of the enterprise is 667,000 kronen.

The contract has been recently awarded for a power-distribution system of considerable extent in Spain. It is to utilize the water of the river Ter, and by the present project which calls for a 165-meter head of water, it is expected to secure 16,000 horsepower. The current will be sent over a fifty-five-mile power line to Barcelona. The intention is to operate the line at 54,000 volts. A. DE C.

GREAT BRITAIN.

(Special Correspondence.)

LONDON, JANUARY 2.—News has been received in London of a report by the Railway Commissioners of Victoria, criticizing the famous report by Charles H. Merz of London in relation to the conversion of the Melbourne railways to electric traction. This report is an adverse one to the electrification scheme—not, of course, in its engineering details, but as to the estimated savings from electric traction having regard to certain local conditions, more particularly in reference to the possibilities of the steam-rolling stock. The Railway Commissioners, therefore, recommend that the conversion of the Melbourne railways to electric traction should not be carried out at present. This decision, which will be received with regret by electrical manufacturers, has been reached apparently on the sole ground that the financial improvement with electric traction is not regarded as sufficient to justify the very large capital expenditure which will be necessary for the purpose.

For some time past, negotiations with Marconi's Wireless Telegraph Company have been carried on for obtaining meteorological reports by wireless telegraphy from liners crossing the Atlantic. The purpose of the negotiations was to make a trial of three months' duration, in conjunction with the Deutsche Seewarte, Hamburg, Germany, of an international system of wireless meteorological reports. It was originally hoped that the international arrangements would be completed in time for the contemplated trial to begin with the first day of 1909, but it has been found necessary to postpone the trial until February. In the meantime the owners of the Allan, American, Anchor, Atlantic Transport, Canadian Pacific, Cunard, Dominion, Red Star and White Star lines, all of which have ships carrying wireless apparatus, have courteously promised their assistance, and the Marconi Company had arranged to notify their officials. The necessary instructions as to observing and coding for distribution to ships of the lines mentioned have now been issued, and in order that the experince of so important a month as January may not be missed, the shipping companies have been asked to allow their officers to report observations to the Meteorological Office upon the forthcoming passages.

It is said that a company is to be formed in Durban, South Africa, for acquiring and working an electrical process for the production of disinfectant from sea water.

The first electrically-driven main winding plant in Great Britain has just been put into operation in a South Wales colliery. I will add some details of this in a later issue. G.

EASTERN CANADA.

(Special Correspondence.)

OTTAWA, JANUARY 7.—Application is being made to the Parliament of Canada for a charter incorporating the Mexican Northern Power Company, Limited. The corporation is promoted by Canadians and will soon begin operations in the northern part of the Mexican republic. The authorized capital stock is $10,000,000, and of this amount $7,500,000 has been issued. There is also a bond issue amounting to $5,000,000, but the authorized amount will reach $7,500,000. A valuable concession has been granted by the government of Mexico for the development and utilization of the waterpower on the Conchos River in the state of Chihuahua to supply electrical energy to the mining centers, cities and towns of that district. The concession is perpetual and absolute. W. F. Tye, formerly chief engineer of the Canadian Pacific Railway, is consulting engineer of the new company. He has spent many months in northern Mexico in the interest of the company, and reports, cojointly with James Dix Schuyler, of the Panama Canal staff, that 25,000 horsepower can be developed. B. F. Pearson, of Halifax, Nova Scotia, is president of the new concern. Some two years have been spent in investigating the power and its possibilities.

It is now officially announced that the Grand Trunk Railway has decided to introduce the telephone in the transportation department, and that it will gradually supersede the telegraph in the operation of trains. W. W. Ashald, superintendent of telegraph for the system, says that while it has not yet been definitely decided by the management just where the initial installation will be made, it will in all probability be on the single track east of Montreal, a section of the main line to Portland. Mr. Ashald says that the superiority of the telephone over the telegraph has now been completely demonstrated. The installation on the double track of the Grand Trunk, between Montreal and Chicago, is less urgent than the change on the single-track lines.

A meeting was recently held in Ottawa by a number of capitalists interested in the project of a belt line of electric railway connecting the principal towns and villages of the central Ottawa valley and the St. Lawrence front. A charter for a part of the projected line is already in existence, and it was decided to take steps to secure authority to construct the remainder. The extent of the line would be about 200 miles. W.

WESTERN CANADA.

(Special Correspondence.)

WINNIPEG, JANUARY 7.—The Preston Car Company, of Preston, Ontario, has been awarded the contract to supply cars to the municipal street-railway system at Edmonton, Alberta. The contract price is $3,225, f. o. b. Edmonton, but this price does not include the motors, which will bring the price per car to $5,400.

The route for the municipal street railway to be built at Calgary, Alberta, during the coming summer at a cost of $478,000, has been mapped out by the commissioners and includes only one suburban line, the commissioners having decided to build to Hillcrest only this year. Mayor Jamieson may be addressed for information.

A. J. Richards, manager of the government telephone system in Edmonton, Alberta, has been appointed to succeed A. E. Morrison, superintendent of government telephones at Calgary, Alberta. O. Higman, engineer, has taken the position vacated by Mr. Richards, and Mr. Morrison goes to Minneapolis, Minn., to accept a position in that city.

The board of directors of the Northwestern Telephone Company, with head office at Saskatoon, Sask., has been reorganized. The following comprise the board for 1909: President, J. C. Drinkle; vice-president, W. J. Bell, and managing director, J. W. Hair.

At the last meeting of the City Council of Edmonton, Alberta, $280,000 was voted for improvements and extensions to the water-

works and electric-lighting systems. Address Mayor Macdougall for information.

James D. Schuyler, of Los Angeles, Cal., has advised the British Columbia Electric Railroad Company to build a seventy-five-foot dam at the mouth of Coquitlam Lake. This will form a vast storage reservoir and increase the power supply of the company. The suggestion has been presented to the provincial government, whose sanction is necessary before the work can proceed. R. H. Sperling at Vancouver, British Columbia, is general superintendent of the company.

The ratepayers of Saskatoon, Sask., have approved a by-law authorizing the expenditure of $30,000 on extensions to the municipal electric-lighting plant. Mayor Clinkskill can furnish information concerning the plant. R.

IMPORTANT DEVELOPMENTS.

PLAN WATER STORAGE FOR POWER PURPOSES IN NEW YORK STATE—The Water Supply Commission of the state of New York will submit to the next session of the Legislature at Albany plans for an elaborate system of water storage in the Adirondacks and other regions of the state. In a general way the commission recommends the impounding of streams in huge reservoirs at points where the maximum amount of power can be obtained. These dams, some of them of enormous extent, are to be erected by the state, and the waterpower is to be rented to private concerns, a plan which, it is claimed, will net the state a handsome profit on the investment. Engineers of standing have been employed by the commission for some time in perfecting these plans, which have been carefully gone over and the cost of each dam figured out. It is believed the plans of the commission will meet with the governor's hearty approval, as he has advocated a proper conservation of the waterpowers of the state in all of his messages, and the scheme of the rental of waterpower to private companies received his emphatic endorsement when he vetoed a bill granting water rights to a corporation and insisted on the substitution of a measure which required the corporation to pay a rental to the state. The whole plan, which is said to be one of the most important economic measures proposed in many years, has been worked out to the smallest detail.

PERSONAL MENTION.

MR. B. F. CRESSON, general manager of the Easton (Pa.) Gas and Electric Company, was presented with a loving-cup, on New Year's Day, by his 1908 staff of officers.

MR. THOMAS GRAHAM GRIER, well known among Chicago electrical men, will deliver a lecture on the Panama Canal, before the Royal League, Chicago, January 25.

MR. SIMON BAMBERGER, of Salt Lake City, Utah, president of the Salt Lake & Ogden Railroad, has been in Chicago, where he was making arrangements for the electrification of the road.

MR. A. C. WESTPHAL has resigned as manager of the electric-light plant at Staples, Minn., and is succeeded by Mr. John Effinger, who has been employed in the municipal lighting plant at Austin, Minn., for the last eighteen years. C.

MR. FRED W. HULME has secured the Chicago agency for the Moloney Electric Company and will handle the Moloney transformer, in addition to the Grant flaming-arc lamp, at his headquarters in the Old Colony Building, Chicago.

MR. W. F. SMITH, for the past seven years superintendent of the Toledo, Bowling Green & Southern Railway, now under lease of the Toledo Urban & Interurban, has been elected general manager of the street-car system of Dayton, Ohio. H.

MR. LESLIE R. HICKS has resigned his position in charge of the electric-lighting department of the Elgin, Aurora & Chicago Railroad Company at Elgin, Ill., becoming electrical engineer of the Fall River Electric Light Company, Fall River, Mass.

MR. HENRY C. MORRIS, for several years assistant general manager of the Bay City (Mich.) Traction and Electric Company, and the Bay City Gas Company, has severed his local connections in order to go to Dallas, Tex., where he will engage in special work.

MR. HOMER E. NIESZ, manager of the Electrical Trades Exposition Company, Chicago, returned last week from Hot Springs, Ark. Mr. Niesz's many friends will be glad to learn that he is again enjoying the best of health and is once more "in the harness."

MR. H. L. MONTGOMERY has succeeded Mr. M. C. Turpin as general manager of the Auburn (N. Y.) Light, Heat and Power Company. Mr. Eugene Creed succeeds Mr. Montgomery as new-business manager. Mr. C. A. Callendar has been appointed superintendent of the company.

MR. J. J. ESTABROOK resigned as secretary and vice-president of the Engineering Specialty Company, Stamford, Conn., on January 1. He will locate in the Havermeyer Building, New York city, with a full line of small standard and special motors, and generators, motor generators, etc.

MR. FRANK G. BOLLES has been appointed commercial engineer with the Allis-Chalmers Company, Milwaukee, Wis. This post has been recently created. The duties of this position will be largely of a diplomatic nature and the affable and cultured Bolles is the right man in the right place.

MR. FRANK A. POOR has resigned as sales manager of the Bay State Lamp Company, Danvers, Mass., to become general sales manager of the Hygrade Incandescent Lamp Company, of 136 Liberty Street, New York, and Danvers, Mass., manufacturer of Hygrade carbon, tantalum and tungsten lamps.

MR. WM. HARPER BUTLER, formerly general manager of the Portage County (O.) Telephone Company and at various times prominently connected with many electrical interests, was married to Miss Blanche Wasson at Cincinnati on December 29. The bride is a sister of Mrs. Homer E. Niesz, wife of the manager of the Chicago Electrical Trades Exposition Company. The marriage ceremony was performed at Christ Church. After a wedding breakfast at the Sinton Hotel, Mr. and Mrs. Butler left for St. Louis, where they were the guests of President J. S. Thurman of the General Compressed Air and Vacuum Machinery Company, with which Mr. Butler is now connected as Chicago district manager.

MR. HUGO REISINGER of New York city, well known by the electrical trade as the exclusive importer of "Electra" arc-lamp carbons, has been made honorary fellow for life of the Metropolitan Museum of Art. To his large circle of intimate friends Mr. Reisinger has long been known as an art connoisseur who has devoted most of his spare time to the patronage of German art, of which he owns the best collection in this country. He was principally instrumental in bringing about the exhibition of German contemporary art now being held at the Metropolitan Museum. The certificate of his appointment to life fellowship was presented to him by Mr. J. P. Morgan, president of the board of trustees.

MR. J. MIFFLIN HOOD, JR., has been appointed chief engineer of the United Railways and Electric Company, of Baltimore, Md., to succeed Mr. Charles O. Vandevanter, who resigned. Mr. Vandevanter's resignation was wholly voluntary. He was formerly chief engineer of the Western Maryland Company. Mr. Hood received a degree in civil engineering from Princeton, and since graduation has been connected with railroad construction work in various parts of the country. With Mr. Vandevanter he was lately of the engineering firm of Vandevanter & Hood, of Baltimore. Mr. Hood is the son of the late Gen. John M. Hood and has followed the profession of his father, who was the president of the United Railways and for twenty-eight years president and general manager of the Western Maryland Railroad.

MR. THOMAS A. EDISON, according to an interview printed in the *Newark (N. J.) Star*, is now engaged in the development of a storage battery which, applied to the ordinary city street-car system, will enable the accumulators carried by the cars to be charged during the night or hours of relatively low station power demand, thus avoiding the present heavy evening peak-load when both lighting and transportation systems require large amounts of current, and enabling the use of generating machinery of smaller capacity. Mr. Edison is quoted as declaring that such batteries, carried under the seats, would propel the car for 100 miles of city service run, as this system can be made regenerative. A car built along this line will be completed in the spring and then experiments will be made on the local Third Avenue surface line, it is said.

MR. G. W. ARMSTRONG, the energetic western manager of the Excello Arc Lamp Company, returned last week from an extended trip covering the Southern and Western States. He was away nearly seven weeks and visited the most important cities between Chicago and New Orleans, and then covered the Pacific slope, returning by way of Seattle and St. Paul, covering over 9,000 miles. The principal mission of the trip was to make known to the many possible users of arc lamps in the southern and western territory the advantages of the Excello flaming-arc lamps. Sample lamps were carried and demonstrations given in every city of any importance, explaining to central-station men, their salesmen, and the representatives of the Excello company every detail of the lamp, how it should be used, its advantages, etc. Many of the companies Mr. Armstrong visited, called in their salesmen in order that they might receive the benefit of his knowledge of the flaming-arc business. Some excellent contracts for direct representation were made, and, in addition, a great many new customers were added to his company's already large list. He was particularly pleased to place the Excello with the Union Stock Yards, Denver, and, although its adoption meant an additional expenditure of about $700, the Denver corporation was willing to spend this extra amount in order to obtain what their engineers considered the best lamp. Mr. Armstrong is one of the best posted flaming-arc lamp men in the country, and his enthusiasm and energy have been greatly instrumental in bringing the Excello to the front, and the company is to be congratulated in having so able a representative to look after its interests in the West.

ELECTRIC LIGHTING.

(Special Correspondence.)

LORETTO, NEB.—E. J. Mille will install an electric-light plant at Loretto. C.

LEWISTOWN, MONT.—The Citizens' Electric Company is planning an extension to Moore.

MODESTO, CAL.—The La Grange Light and Power Company has been granted a franchise at Modesto. P.

MURRAY, IA.—G. M. Miles, of St. Louis, Mo., has been granted an electric-light franchise at Murray.

KEOKUK, IOWA—The Keokuk Gas and Electric Company has been incorporated with a capital stock of $300,000.

ST. HELENA, CAL.—Henry Brown has been granted an electric-lighting franchise for the term of fifty years. A.

TOPPENISH, WASH.—The City Council has granted an electric-lighting franchise to the Northwest Light and Water Company. A.

SOMERVILLE, TEX.—The Somerville Electric Light and Manufacturing Company has been incorporated with a capital of $10,000. P.

PORTLAND, ORE.—The J. C. English Company has been incorporated to engage in the electrical supply business at Portland.

HUDSON, WIS.—The City Council has granted the contract to furnish street lights and pump water to the Burkhardt Power Company. C.

HOKAH, MINN.—The new owners of the Weber flour mill propose to install an electric-light plant and furnish the village with electric light. C.

RED LAKE FALLS, MINN.—The City Council has under consideration the renewal of the lighting franchise to the Red Lake Falls Electric Light Company. C.

TOWER CITY, PA.—The Sterling Electric Light Company has started up its electric-light plant at Tower City. H. T. Bressler has been made manager.

MINNESOTA CITY, MINN.—A deal is pending by which the La Crosse Water Power Company may take over the plant of the Minnesota Light and Power Company. C.

BOZEMAN, MONT.—The contract for the city lighting has been let to the Madison River Power Company at seven dollars per light per month for a period of two years and eleven months. C.

LEWISTON, IDAHO—W. H. Bourke, of Spokane, Wash., has applied to the City Council for a twenty-five-year lighting and power franchise, agreeing to build and operate a plant at Lewiston. A.

FOWLER, KAN.—R. B. Flesch & Company have been granted a franchise for an electric-light, water and ice plant. A plant will be built involving an expenditure of between $10,000 and $25,000.

MONANGO, N. D.—The little town of Monango expects to install an electric-light plant in the near future and assures a paying investment to the capital willing to undertake the improvement.

NEW ALBANY, IND.—Fire which started in the electric-lighting plant of the Ohio Falls Iron Company's old mill damaged the machinery and mill to the extent of about $1,000. The damage will be repaired.

PINE CITY, MINN.—The Pine City Milling and Electric Company is promoting the development of a power plant on the Snake River, seven miles east of Pine City, which will supply the town with electric light.

ALBANY, N. Y.—Assemblyman John D'Brian has introduced a city hall lighting bill calling for a bond issue of $37,500 to meet the expense of equipping the city hall and county building with electric lights.

PARK RAPIDS, MINN.—A twenty-year franchise for electric lighting has been voted to L. H. Rice. He will improve the plant and probably develop waterpower on Potato River, five miles north of Park Rapids. C.

SAN AUGUSTINE, TEX.—The San Augustine Light and Power Company has been incorporated with a capital stock of $6,000 by W. N. Foster, J. W. Garrick, T. B. Saunders, T. L. Foster and F. K. Nance.

LOS ANGELES, CAL.—C. A. Short and H. R. Elliott, of Salt Lake City, Utah, are in Los Angeles promoting the power development which is to furnish electrical energy for the mines of Gold Spring and neighboring camps. A.

TENINO, WASH.—The telephone exchange, power and light plant and the water systems of Tenino have been taken over and will be run under one management by W. D. Hayes and S. W. Fenton. A number of improvements are planned for each department. A.

SPOKANE, WASH.—The Big Bend Light and Power Company is completing plans for the construction of a plant to develop 15,000 horsepower. Work is to commence in the spring. The site of the plant is on the Spokane River. A.

TACOMA, WASH.—The people of Tacoma will vote on the proposition to build a municipal power plant. Although strong opposition has developed, it is believed that the majority of voters favor the plan. The plant is to cost approximately $2,000,000.

ECORSE, MICH.—The gas-lighting franchise in the village of Ecorse expires shortly and the citizens are discussing the matter of electric lights. A municipal lighting system is not considered possible, but an effort will be made to secure electric power from Detroit.

PASADENA, CAL.—Plans for the completion of the municipal lighting plant have been presented to the City Council by Manager C. W. Koiner. These call for a bond issue of $150,000 and the purchase of the overhead distributing system of the Edison Electric Company. A.

EATON RAPIDS, MICH.—The municipal lighting plant at Grand Ledge, which has been giving poor satisfaction for a long time, has finally gone out of commission. The matter of furnishing lights has passed into the hands of the Commonwealth Power Company by contract.

LEXINGTON, KY.—Articles have been filed incorporating the Midland Electric Company, formed for the purpose of acquiring the new lighting franchise recently sold by the city of Lexington to the Kentucky Water, Heating and Illuminating Company. The capital stock is $100,000.

LEWISBURG, TENN.—The town of Cornersville is soon to be lighted by electricity, the power to be furnished by the plant at Lewisburg. The Lewisburg Light and Power Company recently purchased the Lewisburg plant and will establish a new plant of greater capacity.

ELLWOOD CITY, PA.—At a cost of $300, the electric-light plant has been put in shape for operation by City Electrician Nolan. The station has been out of service for a number of years, but Mr. Nolan is confident the Council will vote to allow the city to operate its own light plant.

ORMSTOWN, QUE.—A disastrous fire broke out in the dynamo room of the Ormstown electric-light plant and quickly spread to Walsh's rolling mill. In two hours both the electric-light plant and the mill were a total loss. The property was insured to the extent of $7,500, but this will not nearly cover the loss.

SHEBOYGAN, WIS.—The J. M. Kohler Sons Manufacturing Company, of Sheboygan, is electrifying its plant at Riverside. Electric motors will be employed for power purposes. Acker & Schiffeffneder are installing a switchboard at a cost of from $3,000 to $4,000, and the cost of the entire equipment will amount to about $15,000. C.

HARTFORD, CONN.—The Rocky River Power Company is to petition the Legislature for a broad franchise to harness the Housatonic River in Litchfield County. It will ask for the right to erect dams at Cornwall and Sharon and to operate manufacturing plants in those towns from power generated at its electric plants.

ASHEVILLE, N. C.—George W. Vanderbilt has turned over to the Asheville Electric Company his electrical equipment and contracts for lighting houses in Biltmore village and Kenilworth Inn. Mr. Vanderbilt bought electric power from a waterpower plant, and has made a good profit in furnishing the light to Biltmore residents.

DANVILLE, ARK.—The Danville Electric Light Company, of Danville, has filed articles of incorporation. The capital stock is $100,000, all subscribed. The incorporators are: D. F. Montgomery, president; J. B. Graydon, vice-president; George Leming, secretary; A. M. Falls, treasurer; C. T. Meadows, W. T. Blackburn and T. L. Pound.

HOOD RIVER, ORE.—The Tucker power site on Hood River has been purchased by Dr. J. F. Watt and A. S. Watt. A company will be organized under the name of the Watt Development Company. It is estimated that 8,000 to 10,000 horsepower can be developed and brought to the city of Hood River for manufacturing and other purposes. A.

RACINE, WIS.—The Light and Power Company of Delavan, Wis., has been ordered sold by Judge Belden. Suit had been brought by Edward F. Williams and A. H. Kendrick, trustees for holders of bonds of the company, to foreclose the mortgage. The company issued $30,000 in bonds and neither principal nor interest was paid when due.

EL RENO, OKLA.—Henry Schafer and J. W. Maney, promoters of the interurban electric line between Oklahoma City and El Reno, and other prospective towns, have purchased the electric-light plant at El Reno for $224,801. They will utilize the plant for a power house at the El Reno terminus of the railroad line, besides furnishing lights for the city.

ALFRED, ME.—The installation of the new power plant on the Little Ossipee River, which will transmit light and power to the Limerick Mills, about four miles above, is progressing rapidly. It is expected that the mill will be operating in full by electricity this month. The plant is equipped with 4,000 spindles. J. F. Moore is president and C. G. Moulton is treasurer.

MILWAUKEE, WIS.—The Greater Milwaukee Association has taken up the problem of the proper lighting of Grand Avenue and Wisconsin Street, between Eleventh Street and the lake front. Conferences have been held by Secretary C. M. Towne and W. B. Weller with President John I. Beggs, of the Milwaukee Electric Railway and Light Company, along the lines suggested at a recent special meeting.

BUCYRUS, OHIO—After many difficulties Bucyrus will have a lighting plant of its own in the near future. The issue of bonds for the building of a new municipal lighting plant had been held up by an injunction granted by Judge Babst on the petition of a taxpayer. Judge Young has dissolved the injunction and the bonds will now be issued without delay. The sum of $90,000 will be spent on the plant. H.

SEATTLE, WASH.—Mayor John F. Miller, of Seattle, favors a charter amendment which will separate the city water and light departments, creating an assistant superintendent, who will have entire charge of the lighting system. The present superintendent of both departments is seriously burdened, and it is believed that under separate management the municipal lighting plant can be made productive of more revenue.

BARBOURSVILLE, W. VA.—The United Utilities Company, of which L. L. Dowthat is manager, is planning to construct a combined electric, water and steam-heating plant. The equipment is to include one twenty-five-kilowatt 225-volt direct-current generating unit; one fifty-gallon turbine pump; two 150-horsepower boilers to operate at 125 pounds, and a three-panel switchboard for 220-volt generators to operate in parallel on six fifty-lamp light and power circuits.

MUSKEGON, MICH.—A second high-tension line will be strung from Croton to Muskegon by the Grand Rapids-Muskegon Power Company. It is probable that the new line will be built within the year, passing through the villages of Fremont and Newaygo, provided sufficient business can be obtained to warrant the extension of these two villages. The Grand Rapids-Muskegon Power Company now operates a 110,000-volt transmission line from Croton Dam to Grand Rapids, as well as a 72,000-volt line from Rogers Dam through Croton to Grand Rapids and Muskegon.

REDDING, CAL.—The fourth power plant of the Northern California Power Company has been started up, adding 3,000 horsepower to the company's system, making a total of 13,000 horsepower. The new plant is in the Shingletown country, near Volta, where the company has two other plants. Still another plant is at Kilarc, east of Redding. A fifth plant is under construction on South Battle Creek, where 5,500 horsepower will be developed electrically. A sixth plant will be put up five miles below this one, at the foot of Inskip Butte, and 8,500 horsepower will be developed there.

SPRINGFIELD, MASS.—John Hall, Jr., of 1892 Riverdale Street, has completed a tide water power device on which a patent has been granted. The generator is in the form of an inverted stationary tub or tank with holes in the bottom so that the water enters and causes the air in the tank to be compressed, thus generating power. When the water or tide recedes a partial vacuum is formed. In the model which Mr. Hall has at his home there are four small tanks placed in a reservoir and he has already been able to operate by the compressed air so produced, a one-and-one-half horsepower engine.

RUTLAND, VT.—An addition to the Chittenden dam, which will mean almost the doubling of the capacity of the waterpower, is being discussed by the Rutland Railway, Light and Power Company. General Manager George S. Haley has stated that in all probability the dam will be raised in the near future. The plan, if carried out, will increase the water storage capacity of the dam about 400,000,000 cubic feet. At present the dam backs up about 500,000,000 cubic feet of water and the extra ten feet of masonry will increase the capacity more than 400,000,000 cubic feet. The dam at present is forty feet in height.

BELLINGHAM, WASH.—Under the agreement with the Forestry Bureau, the Skagit Power Company must have its plant completed within three years. Included in the preliminary work in the erection of the plant will be the construction of a railroad from Rockport to the dam, a distance of twenty-eight miles, and the harnessing of Bacon Creek, which will supply 300 horsepower for construction work. The dam for the main power plant will be 112 feet high. Water will be conveyed to the plant through a tunnel twenty-eight feet in diameter, with a drop of 380 feet. James Biggs, of Denver, and C. Parker, of Colorado Springs, Colo., are the principal stockholders of the company. A.

FLINT, MICH.—Articles of incorporation have been filed by the Flint Electric Company, which expects to construct fifteen dams on the Au Sable River at a cost of $8,000,000. E. F. Loud, of Au Sable, N. S. Potter, of Jackson, and H. Kimball Loud, of Au Sable, are owners of the stock. The new company has been granted a thirty-year franchise, the city receiving the right to revise rates every six years. The company expects to have power in February, 1910, for distribution and will serve the following counties: Arenac, Bay, Cheboygan, Crawford, Gladwin, Gratiot, Genesee, Iosco, Lapeer, Midland, Montmorency, Ogemaw, Oscoda, Presque Isle, Saginaw, Shiawassee and Tuscola. For the purpose of formal organization the capital stock is placed at $10,000, all paid in.

HAMILTON, ONTARIO, CANADA.—Announcement that the directors of the Dominion Power and Transmission Company, Limited, have decided to suspend payment of dividends is attributable in part to the general business depression and also to certain special adverse factors operating at a time when development work was in progress. The completion of the Brantford & Hamilton Electric Railway has cost several hundred thousand dollars more than originally estimated. The authorized capital of the company consists of $9,900,000 common; $10,000,000 preferred, and $5,100,000 limited preferred. The company was organized in January, 1907, under a perpetual charter. It owns and controls the entire electric-light and power business of Hamilton and St. Catherines, Ont., and intervening territory; also entire street and interurban railway business of Hamilton and surrounding territory, serving a population of about 150,000. The company's water-power plant, at St. Catherines, has a capacity of about 42,000 horsepower. Water is taken from the Welland Canal, under lease from the Canadian Government, which with renewal privileges extends to the end of 1965. Its street-railway system consists of twenty-two miles in operation in Hamilton and eighty-three miles of interurban lines partly on private right-of-way.

OBITUARY.

MRS. ROGER V. PETTINGELL died at West Somerville, Mass., recently, and was buried in Evergreen Cemetery, West Somerville, on Thursday, December 30. She was married but three months ago to Mr. Pettingell, the son of Mr. Fred Pettingell, the founder of the house of the Pettingell-Andrews Company of Boston, Mass.

MR. THOMAS DEVINE, traffic manager of the Boston, Mass., offices of the Western Union Telegraph Company, died at his home in Boston. He was born in Providence, R. I., forty-four years ago, and had been connected with the Western Union for nearly twenty years. He worked at many big yacht races, football games, and other events. The Harvard coaches selected him as secretary of the 'Varsity crew in 1906, taking him to England with the crew. Mr. Devine was well known throughout New England.

ENGINEERING SOCIETIES.

TOLEDO SECTION, A. I. E. E.—The Toledo Section of the American Institute of Electrical Engineers at a recent meeting in its rooms in the Builders' Exchange Building, elected the following officers: C. R. McKay, chairman and chairman of programme committee; M. W. Hanson, vice-chairman; G. E. Kirk, secretary; W. A. Hill, treasurer, and J. W. Sharp, chairman of membership committee. H.

BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE—The local executive committee of the British Association for the Advancement of Science, which will hold its convention in Winnipeg next summer, expects a highly successful meeting. Already so many inquiries have been received in connection with transportation and accommodation matters, that the honorary secretaries have appointed C. S. Tyrell, permanently in offices at the University of Manitoba, to give his whole time to the work of preparation.

NEW PUBLICATIONS.

THE KANSAS GAS, WATER, ELECTRIC LIGHT AND STREET RAILWAY ASSOCIATION has published a 110-page book containing the full proceedings of its eleventh annual meeting held at Pittsburg, Kan., on October 8 and 9, 1908. The book contains all the papers read before the association and a roster of its membership. The secretary is J. D. Nicholson of Newton, Kan.

GENERAL ELECTRIC REVIEW—The January number of the General Electric Review contains two mathematical papers by Dr. C. P. Steinmetz, on the subjects of "Thermodynamics" and "Variable-ratio Converters." Other principal articles are: "A Comparison of Present-day Methods of Street Illumination," by N. R. Birge; "Centrifugal-pump Fire-boats," by C. C. West; "Foreign Transportation Problems," by E. F. Colyer, and the concluding installment of the paper by L. T. Robinson and O. Holz on the "Influence of Wave-form of E. M. F. on Core Loss and Exciting Current in Transformers."

TELEPHONE AND TELEGRAPH.

(Special Correspondence.)

TULSA, OKLA.—The Citizens' Telephone Company, of Tulsa, has been organized.

SIOUX FALLS, S. D.—The Cataract Hotel will install a complete interior telephone system. C.

PARSONS, KAN.—J. E. Pefley and others are about to build a telephone system at Parsons.

MERRYVILLE, LA.—The Merryville Telephone Company has been organized with a capital stock of $10,000. P.

EGAN, S. D.—The Moody County Telephone Company has been incorporated with a capital stock of $60,000. P.

ST. MICHAEL, MINN.—The Osseo Telephone Company, of Osseo, will build a local exchange at St. Michael. C.

BELLO, TEX.—The Bello Telephone Company has been incorporated in Bello with a capital stock of $1,000.

OAKWOOD, OKLA.—The Oakwood Mutual Telephone Company has been organized with a capital stock of $600.

BAKER, WASH.—The Skagit River Telephone and Telegraph Company has been incorporated with a capital stock of $10,000. P.

MINNEAPOLIS, MINN.—At the annual meeting of the North American Telegraph Company the directors and officers were re-elected.

CROOKSTON, MINN.—The Tri-State Telephone and Telegraph Company has again applied for a franchise for toll-line connection. C.

VOLIN, S. D.—The Volin Telephone Exchange Company has been incorporated by Iver Bagstad and others, with a capital of $25,000. P.

MERIDIAN, MISS.—The Home Telephone Company contemplates extending its line to Whitfield, Ala. About $400,000 will be expended.

PAWNEE, OKLA.—The Coal Creek Telephone Company has been incorporated by John Wolfe of Pawnee and W. J. Nail and J. M. McKill, both of Ralston.

LEXINGTON, S. C.—Company has been organized with Haskell Schull, president; Marshall Hook, vice-president; W. K. Hook, secretary, and G. A. Kaminer, treasurer.

CUMBERLAND, WIS.—Farmers in the vicinity of Cumberland have merged their various rural lines into the McKinley Telephone Company, and propose building a second exchange. C.

SOUTH RYEGATE, VT.—The Blue Mountain Telephone Company, of South Ryegate, has been formed with a capital of $30,000 to install a telephone system in Groton, Ryegate, Newbury and Topsham.

BROWNWOOD, TEX.—The telephone system of the West Texas Telephone Company, with general offices at Brownwood, is being rebuilt. A new exchange building will be erected and about $30,000 spent in improvements.

MINNEAPOLIS, MINN.—The telephone companies of Minnesota have discontinued the sale of coupon books for toll service, following an opinion rendered by the Attorney-General's office that the books constituted a violation of the anti-pass law, which became effective January 1. C.

DENVER, COLO.—The Naturita Telephone Company, which proposes building lines through Montrose and San Miguel counties, has been incorporated with a capital of $50,000. The principal offices are to be at Coventry. The incorporators are G. A. Akers, H. H. Ross, Henry Pamm, George M. Hook and Arthur Priestley.

AUSTIN, TEX.—A bill affecting the telephone business that will come before the Legislature, now in session, is being drafted by Representative Chester H. Terrell, of San Antonio. It provides that the lines of all local telephone companies in towns and cities of the state shall be connected and that they shall do an interchange of business. D.

BATAVIA, N. Y.—Articles of incorporation of the Pavilion Telephone Company have been filed, with an authorized capital of $10,000. The company is authorized to build lines on the highways in Genesee, Livingston and Wyoming counties. The directors are B. J. Bernd, G. D. Hudson, S. O. Hubbard, M. A. Christman and E. D. Starr of Pavilion, and Horace S. Bradley and D. J. Morrow of Covington.

CHICAGO, ILL.—The Atchison, Topeka & Santa Fe Railroad has announced that it will operate the entire main line from Chicago to the Pacific Coast by telephone instead of by telegraph. The substitution will be carried on as rapidly as possible. Contracts have been let for the installation of the telephone system between Kansas City and Emporia, Kan. As soon as this section is finished work will be begun between Kansas City and Chicago. The entire cost will be about $2,000,000.

TOLEDO, OHIO—A new long-distance telephone company is being formed by James S. Brailey, of Toledo, president of the Toledo, Indianapolis and Cuyahoga telephone companies, president of the United States Telephone Company, and vice-president of the Detroit Home Telephone Company, and his St. Louis associates. It is said that the new company will have contracts for service with nearly 1,000 independent telephone companies and will include every point of importance between Kansas City and New York. It is said that Mr. Brailey will retire from the presidency of the United States Long Distance Telephone Company. H.

ELECTRICAL SECURITIES.

There was a good deal of irregularity in the stock markets last week, Wall Street experiencing a great shock as a result of the Supreme Court decision against the Consolidated Gas Company, the stock of which was the subject of a considerable decline. This decision, by the way, should be studied by all having to do with the financing of public utilities. Trade conditions maintain the recent improvement, although complaint is heard that this is not brisk enough. Nevertheless, it appears to be a fact that there has been a substantial development in every line of industry.

Dividends have been declared upon the following electrical securities: American Light and Traction Company; a quarterly dividend of two per cent on the common stock against one-and-three-fourths per cent for the last quarter, placing the stock on an eight per cent basis; last August the stock was placed on a seven per cent basis, before which it was on a six per cent basis, earnings having been steadily increasing. Also the regular quarterly dividend of one-and-one-half per cent on the preferred stock, both dividends payable February 1. Railway and Light Securities Company; the regular semiannual dividend of $3 per share on the preferred stock, payable February 1 to stock of record January 18. East St. Louis & Suburban Company; regular quarterly dividend of one-and-one-fourth per cent on the preferred stock, payable February 1 to stock of record January 15. Columbus Railway Company; quarterly dividend of one-and-one-fourth per cent on the preferred stock, payable February 1 to stock of record January 15. New Hampshire Electric Railways; regular semiannual dividend of one per cent on the preferred stock, payable January 30 to stock of record January 20. North American Telegraph Company; regular annual dividend of six per cent. Brooklyn City Railroad Company; regular quarterly dividend of two-and-one-half per cent, payable January 15.

ELECTRICAL SECURITIES FOR THE WEEK ENDED JANUARY 9.

New York:	*Closing.*
Allis-Chalmers common	15⅛
Allis-Chalmers preferred	48⅛
American Tel. and Tel. Company (ex. div.)	127½
Brooklyn Rapid Transit	68¼
General Electric	155½
Interborough-Metropolitan common	14¾
Interborough-Metropolitan preferred	41½
Kings County Electric	126¾
Mackay Companies (Postal Telegraph and Cable) common	75
Mackay Companies (Postal Telegraph and Cable) preferred	69
Manhattan Elevated	149
Metropolitan Street Railway	30
New York and New Jersey Telephone	110
Western Union	67½
Westinghouse Manufacturing Company	84
Boston:	*Closing.*
Edison Electric Illuminating (ex. rights)	247¾
Massachusetts Electric	59½
New England Telephone (ex. dividend)	128½
Western Telephone and Telegraph pref	81½
Philadelphia:	*Closing.*
Electric Company of America	10⅞
Electric Storage Battery common	45
Electric Storage Battery preferred	45
Philadelphia Electric	11⅝
Philadelphia Rapid Transit	25½
United Gas Improvement	92
Chicago:	*Closing.*
Chicago Telephone	128
Commonwealth Edison	107½
Metropolitan Elevated preferred	48
National Carbon common	85¾
National Carbon preferred	112

The Commonwealth Edison Company is offering on or before January 18 par and nine dollars bonus for $1,843,000 Chicago Edison 6's, retirable July 1, 1909, and par and six dollars bonus for $5,000,000 Chicago Edison debenture 5's, retirable September 1. This refunding offer is in exchange for its first mortgage 5's at 102 and interest.

ELECTRIC RAILWAYS.

(Special Correspondence.)

CHEHALIS, WASH.—An electric-railway franchise has been granted to W. J. Patterson and others. P.

DAVENPORT, IOWA—The Tri-City Railway Company has declared an increase of capital from $2,500,000 to $3,000,000.

SANDERSON, TEX.—E. McGinley, of El Paso, is promoting the establishment of an electric-light plant at Sanderson.

GOLDFIELD, NEV.—The Goldfield Traction Company has begun work on the local electric-trolley system. A.

DES MOINES, IOWA—The Dubuque, Illinois & Wisconsin Railway Company has been incorporated with a capital stock of $50,000.

SHANGVILLE, MONT.—A ninety-nine-year franchise for the construction and operation of an electric railway has been granted to W. A. Clark. C.

SALMON, IDAHO—Senator McBride has interested the people of Idaho Falls in the proposed electric line to Boise, which A. McCutcheon is promoting. C.

GALENA, S. D.—James D. Hardin, president of the Branch Mint Mining Company, has launched a scheme for the construction of an electric railroad to Spearfish. C.

RAPID CITY, S. D.—A franchise has been granted to the Rapid City & Wyoming Railway Company to construct and operate a street-car line in Rapid City. C.

GLOBE, ARIZ.—Geo. W. P. Hunt has applied for an electric-railway franchise at Globe. Work is to be completed within two years from the securing of the franchise. A.

SPOKANE, WASH.—The Big Bend Transit Company is preparing to commence the construction of an electric plant with a capacity of 10,000 horsepower, according to President Nichols. A.

CHARLOTTE, IOWA—The people of Charlotte have subscribed for about $15,000 worth of stock to aid the Clinton, Maquoketa, Cascade and Dubuque interurban, being promoted by J. T. Wilcox and others. C.

SEATTLE, WASH.—The capital stock of the Loyal Heights Electric Railway Company has been increased from $300,000 to $1,000,000. It is reported that the company's line will be double-tracked and extended. A.

ELYSBURG, PA.—It is reported that Warner Mifflin, of Bloomsburg, will build a trolley line from Paxinos to Elysburg, a distance of about two miles, if power can be secured from the Shamokin Light Company.

LANSDALE, PA.—The Philadelphia Rapid Transit Company is surveying for the construction of an electric railway between Lansdale and Doylestown, giving Norristown a more direct route to Doylestown and Willow Grove.

LOS ANGELES, CAL.—H. F. Vollmer has petitioned the City Council for permission to offer for sale a twenty-one-year franchise for an electric street railway on Fifty-fourth Street, between Hoover Street and Dalton Avenue. A.

HOT SPRINGS, ARK.—It is announced that the necessary capital for the construction of the Little Rock & Hot Springs Railway has been raised. The new line will be about fifty miles long, and it is estimated will cost $1,500,000.

APPLETON, WIS.—Surveyors are working on the prospective route for the projected interurban line around Lake Winnebago. It is unofficially announced that spur lines will be run from Appleton to Neenah and from Appleton to Kaukauna. C.

OAXACA, MEXICO—The Oaxaca City Tramway Company's system in Oaxaca has been sold to the Mexican Southern Railway Company for $300,000. It is reported that the purchasing company will make important extensions and improvements. D.

CHIPPEWA FALLS, WIS.—The Chippewa Valley Railway, Light and Power Company next spring will begin the work of extending its line from Eau Claire to Menomonie. Cars will make through runs from Menomonie to Chippewa Falls in two hours.

ELIZABETH, N. J.—Negotiations are under way for a trolley line from Elizabeth to Linden by way of Rahway Avenue. A conference will be held soon with the Public Service officials. The proposed line would give Rahway residents easy access to Elizabeth and Newark.

ALBANY, N. Y.—The Otsego & Herkimer Railroad, which is a reorganization of the Oneonta, Cooperstown & Richfield Springs Railway, has been incorporated with a capital stock of $1,500,000. The directors include E. P. Holdridge, J. W. McCabe and W. B. Reed of New York city.

SAN FRANCISCO, CAL.—The report of the United Railroads of San Francisco shows that the gross earnings for October, 1908, amounted to $609,042, an increase of $177,460 over the month of October, 1907. For the ten months ended October 31 the gross earnings were $5,677,343, an increase of $1,865,246 over those of the corresponding period in 1907. The net earnings for the month of October, 1908, showed an increase of $141,450 over October of 1907. A.

BISBEE, ARIZ.—The Cochise County Electric Railway Company, of Bisbee, has been notified that the United States Land Office at Washington decided the dispute over the old right-of-way of the El Paso & Southwestern Railroad between Bisbee and Douglas, in favor of the company. A.

RICHMOND, IND.—An interurban freight service has been re-established over the Dayton & Western branch of the Ohio Electric Railway Company's line, after a year's litigation over franchise rights. Through freight to Ohio points is now moving from Indianapolis and other Indiana points. S.

DEL NORTE, COLO.—Preparations are being completed for the construction of the proposed electric line which will connect Del Norte and Alamosa, via Center and Monte Vista. This project was considered at a recent meeting of the Del Norte business men's club and given hearty endorsement.

RHEA SPRINGS, TENN.—It is said that M. S. Gibson, who heads the new management of the Rhea Springs Hotel properties, will within a short time begin the construction of a traction line from Spring City, on the Cincinnati Southern Railroad, to the Rhea Springs Hotel, a distance of two miles.

MONTREAL, QUEBEC, CANADA—President Mackenzie, of the Toronto Railway, says that in the not-far-distant future he expects an electric railway to be constructed on the right-of-way of the Toronto & Niagara Power Company's transmission line, which would connect Niagara Falls directly with Toronto by way of the west shore of Lake Ontario.

VALLEJO, CAL.—The San Francisco, Vallejo & Napa Electric Railroad Company has completed more than a mile of track north of St. Helena, and is planning to run cars into Calistoga by the early summer. New cars for the road are being constructed and additional machinery for the Napa power house has been ordered from the manufacturers. A.

PEORIA, ILL.—B. E. Bramble, general auditor of the Illinois Traction System, will have charge of the finances of the Peoria Railway Company, while General Superintendent Bailey will have full charge of the management of the lines, reporting to General Manager Chubbuck of the Traction company since the resignation of General Manager Nelson. V.

DES MOINES, IOWA—The Des Moines & Sioux City Railway Company has completed financial arrangements for the construction of the road at a cost of $5,000,000. Branch lines will be laid to Fort Dodge, Council Bluffs and Omaha. When all extensions and branches are completed there will be 400 miles of track of standard construction, costing about $25,000 per mile. C.

LOS ANGELES, CAL.—The Pasadena Rapid Transit Company, a new corporation, has announced its intention of connecting Los Angeles with Pasadena by a third-rail electric line. It is estimated that the road will cost between $1,500,000 and $2,000,000. The incorporators of the road are Pasadena men, including George H. Hayes, Horace M. Dobbins, H. W. Smith and others. A.

PEORIA, ILL.—An ordinance giving the Peoria Railway Terminal Company a franchise up Washington Street is being prepared and will be presented to the City Council for action. The ordinance is not an exclusive one, but the favored company is to allow any other company to operate upon the tracks upon the payment of a reasonable fee. The company is to widen the street and pay for the pavement. V.

KITTANNING, PA.—At a cost of about $300,000, the Clarion & East Brady Electric Railway Company proposes to build a trolley line from Clarion to East Brady via Sligo and Rimersburg, a distance of twenty-five miles, and by connecting with a road projected between Butler and East Brady, make a complete trolley route of eighty-six miles from Pittsburg to Clarion. G. E. Arnold, F. M. Arnold and T. S. Arnold, all of Clarion, are at the head of the enterprise.

LINCOLN, ILL.—The Illinois Traction System has just placed an order of additional equipment for both passenger and freight service, including six new electric locomotives, which are expected to arrive in a short time from the shops of the Danville Car Company, and twenty-five box cars and ten new passenger trailers, to be received shortly from St. Louis. The new box cars will be used principally for carrying grain, as this class of traffic has recently been greatly increased.

HARTFORD, CONN.—The Windsorville & East Hartford Street Railway Company has petitioned the Connecticut Legislature for an alteration in its charter so that it may construct and operate four branches, two of which it is proposed shall extend to the Massachusetts state line, one through Ellington and Shaker village to the East Longmeadow line, where a connection could be made with the Springfield street railroad, thus affording a new line to Hartford, and the other proposed branch from East Windsor to Ellington and thence to Somerville, then to the Massachusetts line. A third branch is proposed from Windsorville northwest

to the tracks of the Springfield branch of the New York, New Haven & Hartford road, through Melrose to Somerville. The fourth proposed branch is from Windsorville to Broad Brook, where it would connect with the Rockville branch of the Hartford & Springfield line.

JEFFERSON CITY, MO.—The secretary of state has issued a charter to the North Missouri Central Railway Company, of Columbia, with a capital stock of $600,000. The road is to extend from Mexico, in Audrain County, through Columbia and Cedar City, to Jefferson City, a distance of sixty miles. The directors are: T. F. Whiteside, O. F. Saels, Turner S. Gordon, A. J. Estes, John Williams, E. G. McCallister and C. A. Marshall, of Columbia, and W. C. Carroll, of New York.

MONTGOMERY, ALA.—George Montgomery, superintendent of the Montgomery Light and Water Power Company, expects soon to close up the ends of the new transmission line from Tallassee, which his company is building. This new line will parallel the present transmission line on the same right-of-way. Both lines will be kept in operation, one to be used in case of emergency or failure of the other. When completed the new line and accessories will represent a cost of $100,000. B.

MEXICO CITY, MEXICO—Permission has been granted by the Department of Communications to the Electric Tramways Company to electrify that portion of its line to the Peñon Springs between the penitentiary and Springs. At present this line is operated by mule cars, but within a short time electric cars will be running the entire distance. Application has also been made by the street-railway company for permission to electrify other lines about the city which are at present operated by mules.

ELMIRA, N. Y.—The officers of the Elmira, Corning & Waverly Traction Company and officials of the town of Ashland and village of Wellsburg, Chemung County, have arrived at a settlement of former difficulties, so that the building of the proposed line through the town of Ashland and the village of Wellsburg will soon be undertaken. The traction company built a line from Waverly to Wellsburg, and there is only a stretch of about four miles to build, to make a continuous line from Waverly to Elmira.

AUSTIN, TEX.—Fred F. Beck, representing a syndicate of Buffalo (N. Y.) men, is negotiating with the towns and people living along the line of the proposed electric railway between Austin and San Antonio, for franchises and right-of-way for the line. Mr. Beck declares that the syndicate will begin the construction of the road as soon as the preliminary details are arranged. The road will pass through San Marcos and New Braunfels. The proposed line is about ninety miles long. The power station will probably be located at San Marcos, where waterpower for a hydroelectric plant is available. D.

TOLEDO, OHIO—At a meeting of the bondholders' committee of the Toledo Railways and Light Company and the Toledo & Western, held in the office of Norman B. Ream, New York city, arrangements were made to meet the interest on bonds falling due in January. The amount of the former company is $132,500, and of the latter, $37,500. President Albion E. Lang attended the meeting, submitting a report of operations for the year just closed. The payment of the January coupons puts aside all possible chance of a receiver and is taken as proof of the successful refinancing of these systems. Following the announcement the stock advanced about three-and-one-half points. H.

PROPOSALS.

POLE LINE AT BAKERSFIELD, CAL.—Sealed bids will be received in the office of the County Clerk of Kern County until February 3, for a franchise to erect poles and string wires for transmitting electric power. A.

POST OFFICE AT SHENANDOAH, IOWA—The office of the Supervising Architect will receive sealed proposals until February 15 for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring) of the United States Post Office at Shenandoah, Iowa, in accordance with specifications, which may be had from the custodian of the site at Shenandoah, or at the office of the Supervising Architect.

DATES AHEAD.

Chicago Electrical Show. Coliseum, Chicago, Ill., January 16-30, 1909.

Northwestern Electrical Association. Annual meeting, Milwaukee, Wis., January 20-21, 1909.

American Association of Electric Motor Manufacturers. Next meeting, January, 1909.

Minnesota Electrical Association. Second annual meeting. Nicollet Hotel, Minneapolis, Minn., March 18-19, 1909.

INDUSTRIAL ITEMS.

THE AMERICAN CONDUIT COMPANY, New York, has mailed a card of useful data giving the cost of compacted cement per cubic yard of mortar for various mixtures and prices of cement.

THE KIRKPATRICK CONDUIT COMPANY, 505 Western Union Building, Chicago, has been formed with excellent facilities for the prompt shipment of high-grade conduit. The company's principal factory is located at Grand Ledge, Mich.

THE METROPOLITAN ELECTRICAL SUPPLY COMPANY is putting forward De Ronde's insulating paint and compound, with which it is meeting with considerable success. The paint is used by street railways, elevated roads and steam railroads as an insulating medium.

SYLES R. FRALIC, 81 South Jefferson Street, Chicago, announced the above change of address of office and stockroom. The new quarters afford increased facilities for serving the trade with promptness the specialties made of Barkelow switches and Blake and Clifton products.

THE WESTERN ELECTRIC COMPANY, Hawthorne, Ill., has issued an attractive sixteen-page booklet, No. 1078, relating to the new magneto-telephone wall sets it has lately placed on the market. These telephone sets differ from those which they have replaced in having the line binding-posts enclosed, and in the redesign of the bell, generator and switchhook.

THE CENTRAL ELECTRIC COMPANY, Chicago, is distributing a circular describing its New Wrinkle sockets, for which many advantages are claimed over the older types. Circulars are also being distributed showing the new type of snap-switch sub-base, which has been approved by the Underwriters' National Electrical Association. Information is given for using and installing this sub-base.

THE PETTINGELL-ANDREWS COMPANY, Boston, Mass., treats the subject of "High-Efficiency Illumination" in a handsome pamphlet presenting the advantages of Opalux reflectors, devised to secure proper direction and diffusion of the light rays. Besides a number of illustrations of reflectors and fixtures, photometric curves are given showing the light distribution with various lamps and reflectors.

THE COOPER-HEWITT ELECTRIC COMPANY, Pittsburg, Pa., in preparing "a three-months' calendar for the manufacturer," has indicated its prediction of the growing favor Cooper-Hewitt lamps will meet during this duration of factory installation. Among the advantages named for this illuminant are its economy of current consumption, physiological similarity to natural illumination and the decreased attention required.

THE WAGNER ELECTRIC MANUFACTURING COMPANY, St. Louis, Mo., is revising its mailing list and has sent out post cards asking that they be filled and returned with the addresses of those desiring Wagner literature. A number of new bulletins, now in course of preparation by the company, are on the subjects of polyphase and single-phase motors, generators and synchronous motors, alternating-current elevator motors, and instruments.

THE D'OLIER ENGINEERING COMPANY, mechanical and electrical engineers, contractors and manufacturers, Philadelphia, Pa., in leaflet No. 10 describes steam turbines for direct-connected and belted service for the driving of pumps, blowers and generators. Bulletin series T, No. 9, of the D'Olier Company illustrates and describes horizontal centrifugal pumps designed for various methods of drive and made in several numbers of stages for handling different quantities and pressures of water.

THE LINDSTROM, SMITH COMPANY, 253-261 La Salle Street, Chicago, maker of electric massage vibrators and electrical specialties, has recently brought out a miniature transformer, designed to take the place of the common small medical battery, which may be screwed into any lamp socket. A graduated sliding controller gives any desired strength of current in the secondary. Electric hair dryers, vibrators and applicators, batteries, therapeutic lamps and flashing signs are other articles of manufacture of the Lindstrom-Smith Company.

THE H. W. JOHNS-MANVILLE COMPANY, 100 William Street, New York city, has issued a new catalogue, No. 100, on the subject of "Pipe and Boiler Insulation." The book presents the problems of insulating all kinds of hot and cold surfaces, such as pipes, boilers, furnaces, flues, ducts, etc., as well as insulation for refrigerating and cold-storage work. The catalogue is very complete and bears out the company's idea of "a covering for every condition." It is handsomely illustrated and printed throughout. A copy will be sent upon application.

WARREN WEBSTER & COMPANY, Camden, N. J., specialists in the economical use of exhaust steam, announce that the business heretofore carried on by the American Engineering Specialty Company, with headquarters at Chicago, and branches

and agents in various cities through the Middle West, will be conducted in the name of Warren Webster & Company, with main office and works at Camden. The change will give to architects, engineers, contractors, users and intending purchasers of Webster apparatus the full advantages of the Webster organization, which now covers all parts of the country. No change is to be made in the personnel.

THE GENERAL ELECTRIC COMPANY, Schenectady, N. Y., in bulletin No. 4628, describes its new mercury-arc rectifier, which is an improvement over the older design. The standard rectifier will operate satisfactorily up to forty amperes on any frequency from sixty to 140 cycles, inclusive, although it is designed primarily for sixty cycles, and the maximum direct-current voltage is to be obtained when operating at this frequency. It can be supplied for operation on frequencies from twenty-five to sixty cycles, inclusive, also. The rectifier is designed for operating on either 110 or 220-volt circuits. The bulletin illustrates and describes the standard commercial rectifier set, ignition-battery charging outfit, small-motor rectifier panel, outfit for moving-picture machines, and the garage outfit. It also contains dimension diagrams and other data.

RECORD OF ELECTRICAL PATENTS.

Issued (United States Patent Office) January 5, 1909.

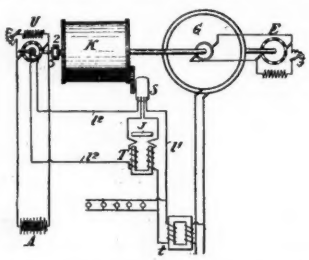
908,439. ELECTROPLATING APPARATUS. Clarence G. Backus, New York, N. Y., assignor to Zucker & Levett & Loeb Company, New York, N. Y. Filed April 13, 1908. A tank contains a rotatable drum and a removable train of gears allowing unobstructed withdrawal of the drum.

908,444. TELEPHONE HOOD. Harry L. Burrhus, Hornell, N. Y. Filed December 20, 1907. A hood has a telephone receiver and transmitter arranged on the inner face of one of its walls, and means for raising and lowering the hood of a person using the telephone.

908,463. INSULATOR. Frederick J. High, West Lebanon, Ind. Filed February 25, 1908. The insulator is formed in two sections, one having a rib and a wire-receiving groove extending transversely and flanges on the opposite section to clamp a wire passing between the sections.

908,474. METHOD AND DEVICE FOR ELECTRICALLY REGULATING THE SPEED OF PRIME MOVERS, ESPECIALLY TURBINES. Friedrich von Merkl, Vienna, Austria-Hungary. Filed January 31, 1908. A direct-connected turbo-alternator and a flexibly-connected rotary converter supply currents out of phase to a motor controlling the regulating means.

908,483. BRUSH FOR DYNAMO-ELECTRIC MACHINES. Edward T. Mug, Norwood, Ohio, assignor to the Bullock Electric Manufacturing Company. Filed November 17, 1905. Braided copper wires are embedded in a transverse channel near the top of the brush, which is then plugged up with fusible metal.



908,474.—ELECTRICAL SPEED-REGULATOR FOR TURBINES.

908,484. DYNAMO-ELECTRIC MACHINE. Edward T. Mug, Norwood, Ohio, assignor to the Bullock Electric Manufacturing Company. Filed November 17, 1905. The brush yoke is rotatably mounted in a recess of the field frame and supported at the bottom on ball bearings and at the top by side-thrust ball bearings.

908,495. SPEED INDICATOR. Heinrich Poth, Brooklyn, N. Y. Filed December 26, 1905. Comprises an electric motor having its rotor connected with an indicator drum and latches holding the latter and adapted to release it in a step-by-step manner.

908,504. COHERER. Frederick G. Sargent, Westford, Mass. Filed May 15, 1908. Comprises a metal electrode, a carbon electrode and a cohering material composed of a mixture of loose, dry zinc and elastic non-conducting particles.

908,530. RAIL JOINT. Benjamin Wolhaupter, New York, N. Y., assignor to the Rail Joint Company, New York, N. Y. Filed October 29, 1907. An insulated rail joint has an insulating sheet between the rail ends and between them and the joint bars and the base plate.

908,538. ELECTRIC-LIGHTING GAS BURNER. Harry L. Baldwin, Washington, D. C. Filed June 1, 1908. A lever for actuating the gas valve carries a movable electrode adapted to contact with a fixed electrode.

908,539. COVERING MACHINE FOR MAGNET WIRE. Albert Beutler, Chicago, Ill., assignor to Belden Manufacturing Company, Chicago, Ill. Filed November 28, 1904. Comprises a hollow spindle, an insulating head mounted on one end thereof and an independently-journaled driving means loosely connected to the other end.

908,545. APPARATUS FOR DECOMPOSING ALKALI-METAL AMALGAMS. Courtland F. Carrier, Jr., Elmira, N. Y. Filed May 25, 1907. Renewed November 17, 1908. A vessel contains the amalgam, an electrolyte and a number of graphite plates in contact therewith.

908,546. CIRCULATING PUMP FOR ELECTROLYTIC CELLS. Courtland F. Carrier, Jr., Elmira, N. Y. Filed December 19, 1907. Combined with the decomposition and oxidizing compartments of a cell is a mercury conduit between them and a pump casing in the conduit having a non-metallic rotor.

908,547. TROLLEY RETRIEVER. Norman W. Chamberlin and Luther V. Moulton, Grand Rapids, Mich.; said Chamberlin assignor to Emily M. Chamberlin. Filed April 3, 1908. Consists of a cord wound on a ratchet, a take-up spring and a retrieving spring.

908,551. TELEPHONE TRANSMITTER. Claude D. Enochs, La Crosse, Wis. Filed October 2, 1906. A microphone cell contains the electrodes and pulverized conducting material with barriers attached to the electrodes and projecting into it to lengthen the path of current through the cell.

908,585. FIRE ALARM. Gustaf P. Leonard, Elkhart, Ind. Filed March 22, 1907. A visual and an audible signal are controlled by electro-responsive devices for each apparatus and there are means whereby the visual signal may be actuated in advance of the other.

908,591. SIGN. Joseph N. May and Clifford A. Treat, Denver, Colo.; Alice May, administratrix of said Joseph N. May, deceased. Filed March 2, 1908. A casing has a light-reflecting back and an opening in its face surrounded by a compartment containing electric lamps.

908,603. METHOD OF TREATING ELECTROLYTIC SLIMES FOR THE RECOVERY OF METALS THEREFROM. Alexander J. McNab, Trail, British Columbia, Canada, assignor of one-half to Walter H. Aldridge, Trail, British Columbia, Canada. Filed November 26, 1906. Consists in treating the slime with ammonium sulphide, whereby antimony and arsenic are converted into soluble sulphides, then depositing the former on a cathode by electrolysis, and separating arsenic from the electrolyzed bath by crystallization.

908,646. INDICATING FUSE. Robert C. Cole, Hartford, Conn., assignor to the Johns-Pratt Company, Hartford, Conn. Filed January 3, 1907. Comprises a fuse link, a shunt-indicating circuit therefor with one portion adapted to be expelled by the force of the disrupted gases of the indicator wire.

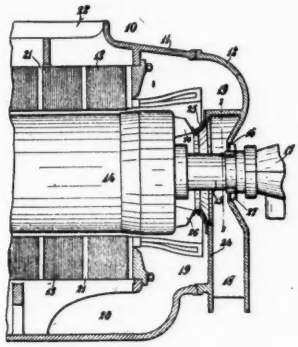
908,647. MOISTURE-PROOF PACKING. Roy V. Collins, New York, N. Y., assignor to American Automatic Switch Company, New York, N. Y. Filed February 8, 1908. An electric track-switch mechanism is contained in a box with a switch-moving shaft protected therein.

908,650. PROTECTIVE SYSTEM FOR ELECTRIC RAILWAYS. Arthur C. Eastwood, Cleveland, Ohio. Filed March 6, 1907. Provides a stationary sectional control conductor along the railroad to which the controllers are connected.

908,654. CIRCUIT-BREAKER FOR AUTOMATIC SIGNALING APPARATUS. Edward A. Everett, Detroit, Mich., assignor of one-fourth to James C. Mock and one-fourth to James J. Ross, Detroit, Mich. Filed November 9, 1907. In combination with a signal-controlling circuit is a relay and means for automatically opening the circuit upon the tilting of the relay.

908,675. FIXTURE FOR ELECTRICITY AND GAS. George H. Jones, River Forest, Ill. Filed June 8, 1908. In changing the chandelier from gas to electric service the lower part of the gas pipe is removed and plugged up and a shell with electric branch pipes is put in its place.

908,679. THERMOSTATIC SWITCHING APPARATUS. William V. D. Kelley, Newark, N. J., assignor to Advertising Mirrorgraph Company, Brooklyn, N. Y. Filed August 30, 1905. A heater of such resistance as to dim the electric lamp when the switch is open is located in proximity to the switch and connected in a shunt around it.



908,686.—VENTILATED HOUSING FOR GENERATOR OR MOTOR.

908,682. MANUFACTURE OF GLOWING BODIES OF REFRACTORY METALS FOR ELECTRIC LAMPS. Anton Lederer, Atzgersdorf, near Vienna, Austria-Hungary. Filed April 3, 1906. Consists in mixing with oxide of tungsten and carbon a small percentage of aluminum, forming the filaments from the mixture and reducing them to pure tungsten by passing a current through them.

908,686. DYNAMO-ELECTRIC MACHINE OF THE ENCLOSED TYPE. Charles E. Lord, Norwood, Ohio, assignor to Allis-Chalmers Company. Filed March 30, 1907. A housing for the machine comprises a receiving chamber and admission chambers having openings around the shaft and fans mounted on the shaft for preventing leakage of air inward around the shaft.

908,694. ROTARY SNAP ELECTRIC SWITCH. Chas. G. Perkins, Hartford, Conn., assignor to the Arrow Electric Company, Hartford, Conn. Filed July 29, 1907. Renewed November 14, 1908. Has a cover with an indicating opening and a shutter to cause the space back of the opening to appear alternately light and dark.

908,698. SIGNALING SYSTEM. Sylvanus A. Reed, New York, N. Y. Filed October 26, 1905. A selective four-party telephone line has two bridged circuits containing oppositely-biased ringers and condensers in series therewith, and two other bridges each connected with ground and containing condensers and inductances on each side of the grounded points.

908,707. ELECTRICAL CLUTCH AND THE LIKE. Abram P. Steckel, Buffalo, N. Y. Filed March 23, 1908. Comprises a member having oppositely arranged separated magnet poles and a second member provided with a series of conducting ring segments, arranged to revolve between the magnet poles.

908,712. ELECTRICAL HEATING APPARATUS. Emmet L. Van Dolsen, Berwyn, Ill., assignor to Western Electric Company, Chicago, Ill. Filed February 23, 1906. A support for electric soldering irons consists of metallic base with a pocket and a standard rising from the base and having contact terminals on an insulating block at its top.

908,719. TROLLEY HARP. John Wickstrom, Warren, Pa. Filed July 6, 1908. Has two plates dovetailed together with a wheel-supporting pin mounted in a recess in one of the plates and held from turning by the other plate.

908,725. RECEIVER. Charles G. Ashley, Chicago, Ill. Filed January 10, 1906. Includes a source of light, an electrically-operated mirror subject to incoming current, and a second mirror so arranged that the reflected rays from both constitute a means for acting on a signal-transmitting device.

908,726. PORTABLE ELECTRICAL TOOL. Frank J. Backscheider, Cincinnati, Ohio. Filed September 27, 1907. Relative moment of the casing and its support actuates a switch for controlling the current to an electric drill.

908,734. ADVERTISING AUTOMATON. Daniel F. Brown, South Framingham, Mass. Filed August 2, 1907. An electric lamp in the shape of a cigar is held in the hand of the figure and made to glow when brought in contact with a plate in its mouth.

908,735 and 908,736. OSCILLATING ELECTRIC FAN. Herbert S. Brown, New York, N. Y. Filed August 10, 1905, and January 5, 1906. A spring-like support for the fan is adapted to bend from side to side and there is an automatic interrupter for the current supplied to the fan motor controlled by the oscillatory movement of the fan.

908,742. SPACE TELEGRAPHY. Sewall Cabot, Brookline, Mass., assignor to Stone Telegraph and Telephone Company. Filed March 18, 1907. A radiotelegraph transmitter consists of a sound circuit, a power circuit including a transformer, an intermediate circuit connected with the first and including the secondary of the transformer, and a condenser connected across the latter circuit so as to increase the power-factor of the power circuit.

908,748. ELECTRIC BLOCK SIGNAL. James G. O. Combs and Isaac D. Combs, Walnut Grove, Mo. Filed March 5, 1908. Electrically-operated means move the support so as to permit engagement with a crank-arm and means to set the signal to danger.

908,751. LIGHT FIXTURE. Alfred C. Cooke, Rockyhill, Conn. Filed October 23, 1907. A foot plate has an opening for a post passing through and rotatable therein and carrying a socket clamp.

908,813. ELECTRICALLY-CONTROLLED LOCK. William H. Stevens, Greenwood, Miss. Filed December 29, 1906. The armature of an electromagnet is constructed so as to hold the lock bar against inward movement.

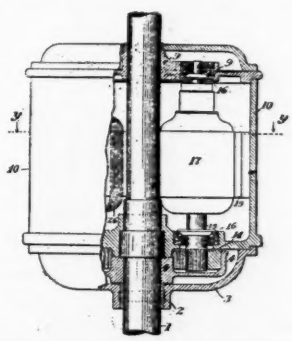
908,814. CONDENSER. John S. Stone, Cambridge, Mass. Filed December 28, 1905. Comprises two dielectrics, one of which is glass and the other a mixture of beeswax and rosin.

908,815. SPACE TELEGRAPHY. John S. Stone, Boston, Mass. Filed March 25, 1908. A modification of No. 908,742.

908,835. IGNITION DEVICE. Edward M. Benford, Mount Vernon, N. Y. Filed January 30, 1908. The construction of a spark plug is described.

908,838. REFLECTOR. Arthur J. Brown, Norwood, Ohio. Filed November 7, 1907. An electric-lamp support carries a reflector and a number of relatively-adjustable plates to permit the formation of a reflecting surface of any desired curvature.

908,846. TELEPHONE RECEIVER. Jesse T. Curtis, Bement, Ill. Filed July 9, 1907. A casing contains a permanent magnet and means for securing it to the casing when in the adjusted position so as to lock its pole pieces in place.



909,057.—MULTIPLE MOTOR.

908,848. ELECTRIC SIGNAL BELL. Harold W. Eden, Detroit, Mich. Filed January 4, 1908. Relates to a special construction of the binding posts.

908,851. AUTOMATIC FIRE LIGHTER. Stephen E. Gamble, Sebastopol, Cal. Filed December 10, 1907. An electromagnet is arranged to open the valve and a spark plug to ignite an oil stove from a distance.

908,868. MEANS FOR CLOSING AN OPEN TELEGRAPH CIRCUIT AT A DISTANT KEY. Carl B. Jewell, La Junta, Colo. Filed March 14, 1908. In combination with a simplex telegraph is a second circuit containing a battery of larger voltage than the normal working battery, and adjusted to operate the relay of any key when the latter is left open.

908,895. ELECTRIC RAILWAY SIGNAL. Charles H. Smith, Lebanon, Pa. Filed December 7, 1907. A contact-maker

consists of a contact piece and resilient arm for carrying the same combined with a two-part carrier.

908,899. ELECTRIC BELL. Edgar P. Steen, Cripple Creek, Colo. Filed May 19, 1905. Consists of a coil having an iron core adapted to act as a hammer for the gong.

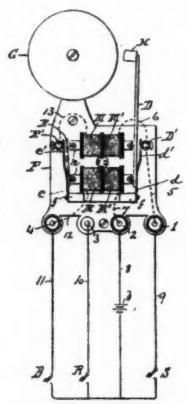
908,906. ELECTRICAL IGNITION APPARATUS. John A. Torrens, Somerset, Coleraine, Ireland. Filed September 17, 1907. A tubular magnet has an armature carrying a striking rod and a hollow sparking plug has a fixed electrode and a movable one actuated by the striking rod.

908,911. PROCESS OF LACQUERING BEDSTEADS. William W. Vincent, Kenosha, Wis. Filed May 22, 1908. Consists in heating the piece by means of electricity and applying thereto while thus heated superposed coats of lacquer.

908,926. THREE-WIRE TELEPHONE SYSTEM. Charles S. Winston, Chicago, Ill., assignor to Kellogg Switchboard and Supply Company, Chicago, Ill. Filed March 12, 1906. The third conductor is isolated from the talking circuit and contains a cut-off relay and a supervisory relay.

908,930. METHOD OF DECARBONIZING FILAMENTS FOR INCANDESCENT LAMPS. Hermann Zerning, Halensee, near Berlin, Germany. Filed October 30, 1906. Consists in placing a filament in a compartment, producing a vacuum therein and heating the filament in the presence of phospham while maintaining the vacuum.

908,937. REMOVAL OF METALLIC PLATING, COATING, OR FOULING FROM METALLIC OR OTHER SURFACES. Thomas R. Bayliss, Northfield, near Birmingham; William R. Hodgkinson, Blackheath; John H. Hardcastle, Lee; Arthur H. Coote, Westcombe Park, and Richard A. E. Payne, Edgbaston, near Birmingham, England, assignors to Kings Norton Metal Company, Limited, London, England. Filed February 18, 1908. Consists of confining within the hollow body an electrolyte consisting of an ammoniacal liquid and rapidly rotating a cathode in the article adjacent to the surfaces to be treated.



909,092.—CALL BELL.

908,979. AUTOMATIC SWITCH LOCK. Charles E. Duffie, Omaha, Neb. Filed July 25, 1907. An electric circuit comprises means for operating the lock, train-operated means for opening and closing the circuit and means for closing a shunt around the latter means.

908,981. TROLLEY-POLE ATTACHMENT. Herman W. Eichbaum, Los Angeles, Cal., assignor of one-half to John Beckman, Rhyolite, Nev. Filed March 28, 1908. The trolley pole carries an adjacent contact roll adapted to be brought into contact with an auxiliary conductor by means of an air-pressure cylinder.

909,017. APPARATUS FOR PREPARING OXONE. David E. Parker, Niagara Falls, N. Y. Filed May 18, 1906. Oxone is prepared from peroxide of sodium in a melting pot having electrodes dipping into it.

909,030. ELECTRICAL CONNECTOR. Gustave A. Schreier, Auburn, Ill. Filed February 16, 1907. An insulating base plate has two terminals thereon, comprising a flanged member with a fixed pin and a separable connector member with a socket for receiving the pin.

909,039. TRAVELING FAN. Frank B. Thilow, Philadelphia, Pa. Filed April 23, 1908. An electrically-charged track carries a traveling hanger adapted to move about upon the track and a fan motor secured thereto having a large and a small bladed fan.

909,040. ELECTROLIER. John H. Thompson, Chicago, Ill. Filed March 13, 1907. A light fixture has a lateral swinging bracket pivotally attached thereto with a horizontal tube, along which the lamp can be moved.

909,043. ELECTRICAL SPARK APPARATUS. Ernest C. Wilcox, Meriden, Conn., assignor to the Connecticut Telephone and Electric Company, Meriden, Conn. Original application filed November 25, 1905. Divided and this application filed February 13, 1908. A box contains a number of induction coils independently removable therefrom.

909,057. ELECTRIC MOTOR. James Burke, Erie, Pa., assignor to Burke Electric Company. Filed January 20, 1905. Combined with a driven shaft are a number of armatures disposed around it in a ring and geared thereto.

909,083. AUTOMATIC SAFETY SIGNAL SYSTEM FOR RAILWAYS. Gardner B. Gray, Pittsburg, Pa. Filed May 11, 1907. Normally-closed circuits on the train control signal devices that are inactive until normally-closed circuits along the line coact with the train circuits and overpower the latter.

909,092. CALL BELL. Saul Katz, New York, N. Y. Filed December 19, 1907. Has two sets of magnet coils and three circuits, one for a single stroke, another for continuous stroke and the third for operating as a buzzer.

909,120. ELECTRIC-CURRENT GOVERNOR FOR DYNAMO-ELECTRIC MACHINES. Leopold Rosenbaum and Frank Voglhut, New York, N. Y., assignors of one-fourth to Moses Radin and one-fourth to Isaac Gerstein, New York, N. Y. Filed January 30, 1908. A centrifugal device secured to the shaft carries brushes bearing on the exposed terminals of a variable resistance.

Reissues.

12,906. TELEGRAPHY. Patrick B. Delany, South Orange, N. J., assignor to Delany Telegraphic Transmitter Company, Augusta, Me. Filed November 20, 1908. Original No. 877,555, dated January 28, 1908. A method of transmission consists in locally producing at a transmitting station short dot signals, simultaneously transmitting to a receiving station a long signal, whose length is determined by the number of dots, and locally reconverting at the receiver the long signal into the same number of dots.

12,907. ILLUMINATING DEVICE. Alfred W. Beuttell, New York, N. Y. Filed March 25, 1908. Divided and this application for reissue filed May 13, 1908. Original No. 831,821, dated September 25, 1906. Double-ended incandescent lamps are arranged end to end along a frame.

12,908. AUTOMATIC WORK-RECORDING APPLIANCE. Samuel S. Berry, Manchester, England. Filed December 20, 1907. Original No. 831,030, dated September 18, 1906. A recording device is actuated by a circuit closer operated by a moving part of the machine and which automatically opens the circuit again.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired January 12, 1909:

466,781. ELECTRIC STEAM-ENGINE GOVERNOR. F. M. Garland, New Haven, Conn.

466,784. ELECTRICAL ANNUNCIATOR. W. F. Harte, Omaha, Neb.

466,787. ELECTRIC INDICATOR. C. W. Holtzer and G. E. Cabot, Brookline, Mass.

466,798. ELECTRIC BATTERY. J. S. Nowothy, Cincinnati, O.

466,800. WIRE SUPPORT FOR ELECTRIC RAILWAYS. W. Q. Prewitt, Lexington, Ky.

466,802. ELECTRIC SWITCH. E. W. Rice, Jr., Lynn, Mass.

466,807. ELECTRIC TROLLEY. E. A. Sperry, Chicago, Ill.

466,825. METHOD OF ELECTRIC WELDING. P. Gendron, Toledo, O.

466,832. ELECTRIC MOTOR CAR. E. B. Phillips, Cleveland, O.

466,858. PRINTING TELEGRAPH. J. E. Wright, New York, N. Y.

466,870. ANNUNCIATOR. D. Heineman, Wabash, Ind.

466,973. ELECTRIC ELEVATOR. William Baxter, Jr., Baltimore, Md.

467,048. ELECTRIC MOTOR. J. H. Palmer, Boston, Mass.

467,050. ELECTRICALLY CONTROLLED CAR SWITCH. B. I. Potter, Boston, Mass.

467,075. ELECTRICAL HEATING APPARATUS. A. E. Appleyard, Boston, Mass.

467,102. NAUTICAL SIGNAL OR SEA TELEPHONE. E. Huber and F. J. Kneuper, New York, N. Y.